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THE SOCIETY'S NEW HOUSE.

On July 29 last the following letter was issued by the President to the Fellows of the Society, in explanation of the purchase of Lowther Lodge, Kensington Gore, as the new home of the Society.

"Dear Sir,

"I have to report to the Fellows of the Royal Geographical Society the conclusion of arrangements for the purchase of new premises for the Society, and to issue a final appeal to those who are in sympathy with the undertaking.

"The amount of labour that we have devoted during the past year to the search for suitable quarters has been very great, and has been attended by many vicissitudes. Despairing of obtaining at a reasonable price a site which would admit of our building upon it a hall for our meetings, and recognizing—although the response to my appeal had been most encouraging—that our resources would not admit of our buying a vacant site and building both house and hall upon it, we addressed ourselves in the first place to the quest for premises in the immediate vicinity of our present quarters, and in close proximity to the theatre that is lent to us by the Civil Service Commissioners in Burlington Gardens. Of the various available buildings in this quarter the most suitable appeared to be the Burlington Hotel, and negotiations for the purchase of this fine block of buildings had almost been carried to a successful issue when they broke down owing to the withdrawal of the vendors. We were then compelled to look rather further afield, and turned our attention to a house in St. James's Square, the situation of which was excellent, but which, being much smaller than the Burlington Hotel, would not have provided for that future expansion of the Society

to which many of us confidently look forward. In default of a better alternative, however, we were pursuing negotiations for the acquisition of this house when it came to our knowledge that Lowther Lodge, the unique house built by Mr. Norman Shaw for the father of the present Speaker, at Kensington Gore, and standing in over 2 acres of its own ground, was in the market. Several members of our Council visited the spot, and all concurred in the opinion that, so far as accommodation is concerned, this house was vastly superior to any that we had hitherto seen.

"The house is splendidly built, and is in a condition of perfect repair. By a happy accident the arrangement of its rooms is so well adapted to our purposes, that with but little change and at a small cost (as compared with the rough estimates of £15,000 and £20,000 which would have been required for structural alterations in either of the buildings which we had previously considered) they can be made ready at an early date for the accommodation of the Society. On the ground floor are a series of reception rooms, which would seem almost to have been constructed for the purposes of a Museum, a Map Room, a Council Room, a Reading Room, and a Secretary's Office. On the first floor there is a fine suite of rooms overlooking the Gardens, which can without difficulty be converted into a spacious Library or Libraries; while closely adjoining are other rooms which can be utilized as Reading Rooms, Writing Rooms, Smoking and Tea Rooms for the Fellows, who will thus enjoy amenities that have never previously been at their disposal. Upstairs, again, there is ample accommodation for the Society's School of Instruction, for the map draughtsmen, the map mounters, and other employés. A roomy and well-built basement, as well as extensive attics, provide for the storage of books or maps on a scale that will satisfy the requirements of an indefinite future.

"Attached to the house are 2 acres of ground, at present constituting a well-wooded private garden, of which it should not be difficult to sell so much as may be required to build for the Society a hall to contain over 1000 persons in immediate proximity to the house on the east side. We should thus be in a position to secure our own hall for nothing, and to solve the problem which has baffled us for half a century, and has driven us to accept the hospitality of Burlington House in a theatre, the discomforts of which have been a source of constant complaint.

"Against these advantages, which are incontestable, and could not, I think, be equalled elsewhere, we had to set the removal of the Society to a site at some distance from its past associations. Upon this point we took expert evidence, and were led thereby to think that neither the Government Offices, nor the young explorers who frequent our premises for practical objects, would suffer at all from the change of situation, while there were those who laid great stress upon the advisability of a Scientific Society being located in a part of London which is becoming increasingly the centre of scientific work, and which, it is thought, will in time attract to

itself almost the entire scientific activities of the metropolis. Moreover, there was reason to think that the new site would be in many ways more convenient to our Fellows who reside in greater numbers in that part of London than in the neighbourhood of Bond Street or Pall Mall.

"There will be some, of course, who either from habit, or from the proximity of our present premises to their clubs, will deprecate the change. These feelings are quite natural. To such, however, it may be pointed out, that what with motor-buses and taxi-cabs and the underground railways, Kensington is only removed by a very few minutes from Piccadilly Circus or Hyde Park Corner, and that these facilities of access are reasonably certain to be augmented in the future.

"But the question is really a larger one than that of individual convenience, and it was because we were convinced that never again is such a chance likely to be presented to the Society of obtaining for a most reasonable sum a site in the heart of London, with a really magnificent house already built upon it, invested with conditions of quietude and distinction that render it equally suitable for purposes of study and worthy of the premier Geographical Society of the world; a site, moreover, that will enable us to have our own hall, to consider the greater comfort of our Fellows, to hold our annual Conversaziones in our own premises, and to provide for the maximum expansion to which we may reasonably look forward—that Council authorized me to enter into negotiations for the purchase of Lowther Lodge before it could be snapped up by some other competitor. These negotiations were fortunately successful, and I am in hopes that when the purchase has been completed and possession obtained, we may execute the few necessary alterations with so little delay as to be able to move into our new quarters at the beginning of the new year. Simultaneously we have been so fortunate as to sell our present house in Savile Row for a price considerably above the reserve which we placed upon it at the auction in May; and we are in negotiation with other persons for the sale of our remaining house in Vigo Street.

"The sums thus procured, together with the fund which I have raised during the past year from the Fellows of the Society, from generous friends and patrons of the Society, and from public bodies and Governments, will enable us to meet the greater part of expenditure which the purchase of Lowther Lodge will entail. At the same time, it would be a great relief to the Council and myself if we could enter upon its occupation absolutely free from any financial obligation; and accordingly I make this renewed and final appeal to our Fellows, both those who have already subscribed and the still considerable number who have not yet done so, to set the seal upon the arduous but triumphant labours of the past year, by providing us with the further sums that are required to secure this most desirable end. I shall be very glad if any of them who may have the opportunity will visit the house and inspect for themselves its peculiar advantages; and I call their attention to the fact that,

whereas fourteen months ago we seemed no nearer to the solution of the housing problem than we had been at any time during the previous quarter of a century, we are now—without any sacrifice to the Fellows, and with no perceptible strain upon our resources—on the verge of entering into possession of what will be the most commodious and distinguished habitation enjoyed by any Geographical Society in the world.

"I am, yours faithfully,

"CURZON OF KEDLESTON,

"*President.*"

In answer to the above appeal, a substantial list of additional contributions has already been received, and it is hoped that others will follow.

An architect has been employed to report upon the necessary alterations, and it is hoped that these may be completed at an early date after the Society enters into possession at the beginning of 1913.

THE WORK OF THE RESEARCH DEPARTMENT.*

By Prof. J. L. MYRES, Chairman.

IT would be no easy matter to conduct the last meeting of this Research Department of the Royal Geographical Society and to review its work if I were not sure that, in closing one chapter of the Society's record of achievement, I am but turning the page where the next is to be inscribed: since the charge which I received from three distinguished geographers who have occupied this chair—Sir Thomas Holdich, Colonel Close, and Dr. Strahan—is destined to the more immediate custody of our President himself and his lieutenants, the Vice-Presidents of our Society. So I come not to bury Cæsar, but to praise him; and to praise is easy—I have only to review the facts. If I add, before I close, one or two phrases of suggestion, it is only lest I should give unawares the impression that we have done more than it was our duty to do: or that we have not been planning as well as building.

The popularity of the Royal Geographical Society during the last generation has entailed, I think, only one embarrassment. Very large meetings cannot, without risk of confusion, be so informal in their procedure as small ones; and there is always, also, the danger that in these large meetings that kind of subject may be found to predominate which appeals (for whatever reason) to the largest number. The record of our Society's administration is before us to show how both these difficulties may be met. But the difficulties do not disappear, and from time to time fresh means need to be devised to deal with them in fresh forms as they recur.

Special afternoon meetings in this map room had already been familiar occurrences for some years, when on February 9, 1903, our Council

* Research Department, May 23, 1912.

approved a memorandum from the President, Sir Clements Markham, recommending the appointment of a special committee to consider what steps might be taken to organize this department of its work. A school of young geographers was growing up, mainly through the Society's own activity and encouragement, who were carrying out research in various departments of the subject, and helping to raise the standard of geography in the country. It was urgent that something should be done to organize the regular supply of the communications which these younger geographers might now be expected to make, and to prearrange meetings at which an audience capable of discussing them might be brought together. The committee was to consist of three or four representatives of the Council, together with several of the younger men who were devoting themselves to this class of work: and this association of the younger geographers with the veterans has been, I am glad to say, the keynote of this enterprise throughout.

On May 18, 1903, the Special Committee was ready with a report; and the Council adopted a series of resolutions, constituting an advisory body, to be known as the Research Committee of the Royal Geographical Society. Under the direction of this committee periodical meetings were to be held for discussions on the results of geographical research and on geographical methods and problems. The Research Committee consisted, and consists, both of members of the Council and of other Fellows chosen by the Council from a list submitted by the Research Committee. As the first list of the committee contained already eighty-one Fellows, in addition to all the members of Council, its business was transacted by an executive of nine, who were to select subjects for discussion, and, in submitting names for inclusion in the Research Committee, were to have especial regard to the merit of papers read before the committee by the nominees. Lest the work of the committee should be hampered by lack of funds, the Council from the outset expressed its desire that the committee should make recommendations for grants not exceeding £200 in any one year, in aid of work proposed or undertaken under the supervision of the committee or at its suggestion. I am sorry to say that the committee has not always been in a position to recommend the whole of this sum to be spent.

In the first programme of the Research Committee, which I have summarized very briefly, examples were given of the kind of research which it was expected might be undertaken: and it is some test of the committee's foresight to classify the papers which have been read and discussed in the nine years of its existence, under the headings which were projected then.

(1) New methods of surveying or mapping or computing, which rightly came first in the list, have been the subject of twelve papers out of fifty.*

(2) Definite problems of geomorphology account for nine, of which

* I am not certain that my total is inclusive.

about half were more or less directly concerned with the formation of river systems or coast-lines: and it should be noted here that the only large pieces of concerted work which have been carried on under the auspices of the committee have dealt respectively with river activity and coast erosion. To these I must return later.

(3) Questions of hydrography account for three communications, all from the same hand; and climatology for three more.

(4) Regional and synthetical studies have been four; but I do not include in this rather small total the preliminary or tentative examination of ill-explored regions; these have a heading to themselves. Of the four regional studies, two were contributed by members of the Oxford School of Geography, which owes its foundation to our Society's encouragement; they formed part of the systematic training of their authors, and were rightly appraised as evidence of the quality of that course.

(5) The investigation of a particular distribution, as of a crop or a type of plant association, produced three papers specifically, and was involved in several other inquiries, particularly in regional and historical geography. Among the specially botanical studies, Dr. Unstead's monograph on the limits of the North American wheat-field is conspicuous for wide range and thorough scientific treatment.

(6) Evidence of physical changes within historical times was discussed expressly in four papers; and taken into consideration collaterally in the three others which dealt with problems in the distribution of man.

(7) Finally, eight communications dealt with geographical exploration (more or less incomplete and provisional) of particular regions or territories, and incidentally (like some other papers already reckoned) of the conditions affecting the development and colonization of such territories. Several of these were submitted by explorers who were also on the list of the Society's evening meetings; they had thus the opportunity of discussing informally among expert colleagues the more scientific aspects of their work. On this direction it may well be hoped that, under the new conditions now projected, the Society will have even larger success in its afternoon meetings, since these are the workers who have the most —though in different ways—both to give and to receive.

Thus, of the headings in the original programme, only three remain blank—historical cartography, military geography, and the special problems of the development and colonization of Central and Southern Africa. The last omission may well be accidental, perhaps, also, people in South Africa have been too busy doing things since the war to have much time to write about them. The first two would probably have been avoided if the study of geography in the older universities had been more closely associated with the historical studies which figure so largely there. The present divorce is probably inevitable as long as the study of historical and literary subjects is regulated so closely, as it seems to be, by the requirements of the Civil Service examination; and as long as those

examinations assign to geography the quite unworthy place to which it is restricted now.

I should be doing very scanty justice, at this point, if I refrained from mentioning the address with which our first chairman, Sir Thomas Holdich, inaugurated the work of the Research Committee. Its policy has, I believe, remained the policy of the committee throughout; it was certainly the memorandum which gave me the clearest lead when it was my privilege to follow him, and his two distinguished successors; and his wise forecast of our work will long point the way along which the Society will continue it.

May I turn now to one or two general reflections on the quality of all our geographical work, and on the ways in which this Research Department means to me to have contributed to enhance it.

We sometimes hear the question discussed what is the position of geography in the hierarchy or (as I prefer to put it) the republic of the sciences; and I have even heard the thesis maintained among friends and colleagues that there is a sense in which some part of geography is not a science at all; but at best a particular mode of application of certain other sciences, either singly or in combination. Perhaps it is natural for a historian, who can at best only claim to be "at home" in historical geography—and, indeed, only in a very few parts of that—to feel some sympathy with this view, so far as it goes; my defence for the apparent outrage of alluding to such a view in this company at all, being that my own complaint against it is, that it does not push its contention to the logical and real issue.

Geography, if I may be allowed to add yet one more to the perilous attempts to define it, seems to me to be that branch of knowledge and research which essays to discover what happens where, and to explain why anything which happens, happens just *where* it does; and under what combination of circumstances it *does* happen *just there*. In this aspect, geography will be recognized as the twin sister of history, which, in the same largest and truest sense, is the branch of research which should discover *when* each thing happens, or happened; and tries to explain under what circumstances *this thing* happened or happens *just then*.

Now in this sense every department of knowledge except the mathematical and philosophical studies, which appear to me to make time and space their playthings instead of their go-cart—has both its historical and its geographical aspect, and in so far, must be itself the province of some kind of historian, and no less of some kind of geographer. In the same way, moreover, all geography too has its historical aspect, and all history its geographical. Historical geography, as we call it, is our attempt to answer the question, why did what happened just *then* happen also just *there?* and at the risk of adding yet one other citizen to the republic of science, I submit that when we try to answer the twin

question—why what happened just *there*, happened also just *then*, we are advancing towards the conception of a geographical history. The parallel between the objects, of geography and of history, and also between the methods of the two sciences, seems indeed to me to be complete; and it seems also to throw some light on the proper aims and limits of geographical work as it lies before a Department like ours.

In history, there is a narrower and popular, as well as a wider sense. In the wider sense, history contemplates, as we have just seen, all the subject-matter of all the sciences, in so far as these phenomena have limit or distribution in point of time. You can have a historical geomorphology (which forms an important section of what we popularly called geology), a historical zoology (what we call palæontology), and a historical technology (which is archæology in its narrower sense), as well as a history of man. And the historian of man is ill-equipped for his own work if he is unable to take account of the distribution and intensity, in point of time, of many non-human phenomena, the existence or non-existence of lions in Macedonia at the time of Xerxes' expedition, or of forests in the Po valley in Hannibal's time; the distribution of rainfall during the successive periods of Barbarian inroad into Europe or into China; or the precise course of the coast line at Thermopylæ or the siege of Pylos. But there is a more rigid and special conception of history also, which restricts it to the fixing of dates, and the formation of chronological charts. This is the map work—the cartography—of history, and it is notorious that in practice the only dates that we chart chronologically are dates in the special history of man. Curiously enough, however, when we wish to fix accurately the distance between dates at all, and especially between dates that are very far apart, we have to desert human evidence of the documentary kind, and fix the positions in time of human events by reference to facts of astronomy, like the eclipse which was total in Cappadocia during the afternoon of May 28, 585 B.C. during a battle in the sixth year of the only known war between the Medes and the Lydians; and the eclipse of April 19 last, which dates the coal strike of 1912 A.D. It is no accident also that the historian and the geographer alike reckon their smaller intervals in minutes and seconds.

Ideally, no doubt, all historical knowledge takes shape in accurate chronological charts recording sequences and co-existences in time, to represent which (since time appears to us to have two dimensions only) we are content with the kind of Mercator's projection which we see in handbooks of history. Ideally, also, no fact of history can be said to have been historically ascertained until it has been charted chronographically, and in a fixed relation of time to all relevant facts. In practice, however, two reservations occur. First, only certain classes of facts are at present within the reach of this line of chronography, and many large classes of fact may never come within its scope at all.

Second, even where exact chronographical data are available, they are far more precise than is at all necessary in practice; for comparison, that is, with the rest of our material, either in daily use, or in what, nevertheless, I think we are right in calling scientific history. In the history of a battle, the sequence of hours and even minutes may be vital; but on most occasions we may be thankful if, like Thucydides, we can reckon by summers and winters. Herodotus, our first master in the writing of history, hardly ever gives a date at all; only a sequence of events, and rarely the hint that an interval was a longish one. Meanwhile, on the other hand, we are painfully aware, in our own practice, that historical accuracy does not necessarily presume historical insight. History, like all other science, is brought into being by human endeavour; it uses weapons of precision if it can obtain them; but it is the man behind the gun who makes the history, and the man behind the pen who writes it. All science in this sense is also a work of art; it requires not only knowledge but judgment; it expresses, not facts alone, but a *meaning*. And the meaning is revealed by *character;* its expression is the achievement of *style*.

I have digressed into the sister science of history so far as I have, because by this analogy—which I believe to be true and useful—I can express most clearly what seems to me to have been the function of this committee in the furtherance of geographical research, and the jurisdiction, if any be needed, of the view which it has taken of the scope and method of geography. What must strike even an onlooker, in geography, as in history, is the immense variety of the subject-matter. What is not so apparent, except from inside, is the identity of the point of view, from which the geographer looks at every part of it. The data and results of every science have their geographic aspect as we have seen; but just as historical studies inevitably centre round the historian himself, and converge upon the doings of Man, so geographical studies converge upon the distribution of the factors which make up Man's habitat on Earth. A well-defined mass of data is thus distinguishable which is geographical in a more special sense. These data all lie between astronomy and geology, the study of the Earth's composition and growth, as the historian's facts all lie between astronomy and psychology, which studies the composition of mind. That is to say, they are all not merely limited in space, but confined to this planet: so that we geographers are restricted to doing for the Earth what astronomers would like to do for all the planets. But in the narrower sense the geographical description of those facts is as different from the larger, as the astronomer's telescopic survey of Mars is from what our knowledge of Mars would be, if the followers of the other special sciences, from the meteorologist to the economist and the historian, had added their labours to those of the astronomer, and brought their results to a point where they could be plotted geographically on to the Martian ordnance survey. The notion,

that is, of geography as the branch of knowledge which is concerned with determining distributions in space on or about the Earth's surface, and the art of recording such distributions in intelligible maps, is at bottom true. Any misapprehension which may arise from insistence on this aspect of our work, results not from any inadequacy in the notion itself, but from the relative immaturity of some parts of our geographical knowledge. If, and when, the subject-matter of these departments can be as fully and as accurately studied and stated as is the Earth's geometric form and physical relief, our survey of them will pass over into the same relationship to applied mathematics as the geodetic, and ordnance, and cadastral surveys have established already.

In the meanwhile, let us note that there were maps, and useful maps, before the invention of the plane table or of trigonometry; and these maps were in the true sense geographical work, however early and immature the phase of geographical practice to which they belong. In the same way, what our non-geometrical geographers are doing now is no less geographical work, though our methods of ascertaining the particular geographical distributions in which we are interested are ungeometrical (which, I admit, means inaccurate) as yet. And being, I think, fully aware of this ourselves, we non-geometrical geographers make a habit of appealing to the fraternity of greater accuracy to come over and help us; and the records of our meetings here are evidence how worthy of the Society the response is, whenever we make such appeal. Distinguished organizers of survey work have been among the most active and valued members of our committee from the first, and their friendly co-operation with biologists and historians has been its mainstay.

Two of our most important researches illustrate this alliance. In the earliest days of the Department two questions were brought before its notice, partly by the accident that they occupied some place in public attention, but mainly for their scientific interest, and for the fortunate chance that the right people were there to do the work, The measurement of the capacity of rivers, and the estimation of coast erosion were problems which needed precise methods of observation, some of which had to be devised or improved as the work went on; they demanded the co-operation of trained observers under an agreed plan; and they promised all that element of uncertainty as to how things would turn out, which gives to scientific work its kinship to the best forms of sport. Neither enquiry is near its close, as yet; but it is already possible to estimate the value of the results; and the Society, when it assumes more direct responsibility for them, has no reason to regret its liability. And it is fitting that I should mention here how much the Department owes, in other ways as well, to Dr. Strahan, who has been its chairman, and is the prime mover in our researches on rivers.

It may be useful to review in this place the actual practice of our meetings in the light of the experience we have gained, and to estimate

what the Department has tried to do on the formal, as well as on the material side.

You will remember that among the departments of geographical work, which have been best represented in the Department, is that of formal cartography: and I venture for a moment to recur to this aspect of our work because it is one in which it is easiest to illustrate what I mentioned a little way back, as to the interrelation of the stricter and the wider aspect of our science. A graphic presentation of a group of geographical phenomena—phenomena, that is, drawn from any realism of nature, and contemplated in their geographical aspects—is a scientific record in the strictest sense of the word. But no one who has ever had occasion to compare any two maps, from different hands, of the same geographical region, can have failed to appreciate that the geographical data are only one factor in the impression which results on the student's mind. The other factor is the personality of the map-maker; it is revealed, perhaps I should say betrayed—for he does not mean to reveal it—in every line of his handiwork; but it is one of the last things which is likely to be reduced to quantitative formulæ, or delimited in its geographical distribution. A finished map, that is, is a scientific document, but it is also a work of art; to its scientific value, its completeness and accuracy, it adds the value which is given by style: that grace which in a map, as in speech or writing, or any art of expression, is perhaps, best rendered by its old Latin name of *eloquentia:* for it is the grace of *speaking out*. A map, no less than a despatch or a novel, has to give a message, without parade, or digression, or confusion; in the fewest and most unmistakable symbols, which have the merits, and also the defects, of all symbols, and are good servants only in trained and sure hands. And what is true of the map, the geographical document in its simplest and most purely geographical form, is just as true of other geographical work; which is all a more or less explicit commentary on maps in literary form, or hints for the comparison of maps with one another. All work of this kind is a work of art; the geographer puts scientific material into it; but he puts something of himself into it as well, it is (as we say) *his* work; and we are right, I think, in taking into account, as geographers, the form into which he casts it, the geographic style which is *his*. This is, of course, true of all scientific work; but it is more true of synthetic work than of work where the conditions are simpler, and the personality of the worker seems in some ways to count for less in the result. And I am inclined to think that one of the reasons why geographical science owes so much as it does, and so far more in proportion than most other sciences, to men who also make their mark in affairs, in large positions of administrative responsibility, is that these men are forced by the practical necessities of their work to take that periscopic standpoint which is, in fact, the geographical point of view. By force of circumstances, if not already by instinct and

training, they become geographers; and as we know well, not geographers only, but pioneers and leaders and organizers in geographical enterprise.

For long, after our national habit, we allowed geographers in this country to be made haphazard; we welcomed them when they appeared; but we did not go out to look for them, or to offer early to the geographers of the future the facilities which a Society like ours accumulates. But we have long outlived that phase of growth; only our oldest Fellows could recall it to us now. We train geographers ourselves in the most essential of all geographical disciplines; by establishing lectureships and schools of geography, we have laid the foundations of a national system of geographical instruction; and we have already some public recognition—however inadequate—for our persistent claim that geographical training is part of the elementary outfit of aspirants to public service.

And in the work of this Research Department we have done something more. Our evening meetings are fully and rightly occupied by the first-hand recitals of striking geographical discoveries. These appeal to large audiences, and these audiences assemble to see and hear some new thing, not to criticize or to discuss, even if the conditions of a large evening meeting permitted this. But it falls to very few to contribute in a striking way to geographical knowledge. Fewer still contribute thus in early life; and not all, even of these, have the natural gift of style which entitles them to the large platform and the public championship of their subject; for in the public eye, inevitably, the subject comes to be judged by what the public sees.

In the meetings of the Research Department practice, criticism, and collateral co-operative illustration have been secured in a less formal way, both for students already trained and—what is as important—for the less-trained man with something to say. Inventions spread so quickly in a scientific world, that one hardly realizes now what a discovery it was, not so many years ago, that a paper could be printed before it was read, and sent round in rough proof beforehand, to collect an audience and ensure discussion. The custom has the further advantage both for writers and for critics, that it puts a premium on brevity and clearness of exposition; and, looking back over our meetings, I trace change and improvement in these vital elements of form. Further, a good student and craftsman is his own best critic; and the effect of our right insistence on "cold print," before a paper is read, has been to put those who have addressed us on this high plane of criticism. Repeatedly the reader of a paper has said to me, not only after discussion, but before, "If I had the paper to write again now, I should do it quite differently." And I am sure that it was only a well-grounded fear of the wrath of Dr. Keltie that has prevented him from doing so. This kind of response to the challenge to criticize one's self I take to be the best evidence that the Department

has been doing good work; and I hope that this custom may be preserved in the Research meetings of the future.

A second valuable point in our procedure lies close to the first. We have never insisted on the reading of a paper in full. We have paid ourselves the compliment—and I believe it has been deserved—of assuming that we had read the printed words, and come prepared to do justice to them.

The next point, which I wish to emphasize, follows closely again. No one expects that the whole of a systematic memorandum can be discussed adequately at a single meeting of an hour and a half; no one expects, either, that a writer's presentation of his subject, if it is to be "in scale" for those who follow it for the first time, will be "in scale" also with the work which he has expended on it, and with the practical difficulties which he sees in carrying it further, when he looks ahead from where he stands now. But it is vital to these meetings that they should help the exponent as well as instruct the audience. So it has been a good custom to encourage the speaker not to adhere too closely, in opening the discussion, to the limits, still less to the proportions, of his written statement. He is there—so we have held—to open a discussion, not to rehearse his paper; and, in opening the discussion, to give us, above all, a lead as to the course which it will be most helpful to him that the discussion should take. And it will be within the memory of members of the Department that some of our best discussions have been those in which this custom has been most fully observed. Of the discussions themselves, it is not necessary to say more than to express the great debt which we owe to distinguished geographers who have honoured us with their presence and their counsel, not once or twice only, but habitually. Direct personal intercourse with the master workman is the best incentive to live work. The friendly encouragement and the still more friendly criticism of veteran geographers, like Sir Clements Markham, who presided when I read my own first paper in this room, are a memory and a motive which does not fade.

Two weak points in the procedure of our meetings here seem to me worth noting, because I think that both of them can and will be remedied under the new conditions which are imminent. That a committee should have a regular chairman was inevitable, and, according to custom, has been also useful as an additional pledge—if that were needed—of continuity in our executive work. But it has never seemed so obvious to me, particularly since I have occupied this chair, that the same person ought to preside habitually over meetings where the work on any one occasion was homogeneous, but where discussions taken all together ranged over so large a choice of subjects. Yet it seemed a little difficult for the responsible chairman to make way for a substitute, without seeming to shirk his duty, and at least without denying himself the pleasure of being there. In future, however, the rules for the chairmanship of the Evening

meetings will govern Research meetings also; and it should be possible to ensure that at almost all these meetings the chairman shall be himself an expert in the subject of the discussion. If it could be ensured that he should also go through the paper beforehand with the author of it, the gain would be greater still. I lay some stress on this point, because such a chairman can do much, which an *ex officio* chairman can hardly hope to do, both to bring the right people together, and also to guide the course of debate.

The other point is one which I raise with more diffidence, both because it concerns matters which lie partly outside this committee, and also because it may well be that the ordinary practice of the Society itself provides the remedy more fully than any one can appreciate who is not in intimate touch with its working. My point is this: When we have had our paper and our discussion, the committee and the student seem to slip apart again. It has seldom happened that we have had a second paper from the same student, on a subsequent phase of the same piece of work. Perhaps the committee has not been in existence very long. The investigations of river action and coast erosion, which are the chief monuments of the Department's activity, are of course conspicuous exceptions; and, besides this, some of our most active investigators have come before us more than once with different kinds of problems. But in the main my observation holds, and, in so far as it is true, it seems to me matter for regret. But it is easy to exaggerate what may, after all, be only an accident of form. After all, the real working of the Research Department has throughout been in the same strong hands as the rest of the Society's activity; general officers of the Society have always been on the committee, and have been constantly present at our discussions; Dr. Keltie has been its secretary throughout, and not much that is of geographical value slips out of Dr. Keltie's net when it has once slipped into it.

How work once brought before the Research meetings can be best forwarded, when need arises, it is not easy to say. Fortunately, such work is often maintained, or facilitated from some other quarter. Large enterprises and public services are already more willing than they were to give elbow-room to the man whose hobby lies within his career. The value of advanced study in conjunction with practical work, and as an essential element in it, is being recognized outside the strict limits of the "applied sciences"; and as advanced study becomes more habitual—as will surely happen—in the large regions of modern life which are still administered by rule of thumb, "applied science" merges increasingly in the trained use of commonsense.

One of the earlier papers presented to the Department contains suggestions on this matter, which might well be reconsidered by the Society from time to time. It is the memorandum by Dr. Scott Elliott, entitled, "Suggestions for an Enquiry into the Resources of the Empire,"

and the gist of it was, that with the best will in the world it is no longer possible for anybody to keep abreast of more than his own corner of a subject without organized help. Such help was offered adequately in a bygone stage of knowledge by the mere establishment of libraries. In the Victorian age the learned societies supplemented the libraries with periodical literature and oral conferences; but only a few of them have done much to make the contents either of libraries or of periodicals accessible to the man who wants to use them. Our own Society has been conspicuous throughout for the attention which it has given to this matter. I know few libraries where it is so easy to find just what one wants, and none where one so often comes out with something invaluable which one did not even know before that one ought to want. And I attribute this mainly to two causes. Considering its size, this Society's library is better served in point of staff than any library that I know—in the amount of thinking, I mean, which goes into the library service, the amount of expert knowledge that is available generously and without stint, to bring the reader and the books together. We regret, naturally enough, that even the wise liberality of authors and publishers does not always enable our library grants to make both ends meet; but we should regret it still more if in the attempt to make both ends meet by way of purchases we overlooked the necessity that library expenditure should be commensurate in other directions too. Within half an hour of the British Museum, a society, even if it has not all the literature of its subject on its own shelves, is not doing its whole work unless its equipment keeps its members in touch with what is going on. This seems to me to be the special value of papers like that on *Morocco*, to which we listened only a few weeks ago. Such a paper is necessarily a short and diagrammatic thing in itself; its significance is, or aims to be, the assurance that the Society is in personal touch with some one man—perhaps in discussion it may turn out that there are three or four—who has seriously grappled with the recent literature of a definite region or problem; has worked with its experts in their own institutions abroad, in all the vital atmosphere of monographs in the making; and is so far equipped and available, if the need arises, to lend a hand to the library, which is the Society's organ of memory. Not much inducement is required to acquire from the contributors of such papers, *at the time*, bibliographical matter, and, what is even more important, estimates of the value of sources, especially those secondary sources which are worth, so to speak, one man's reading once.

Such summaries are, of course, particularly valuable where the recent materials are wholly or mainly in some little-known language. Obvious examples are the geographical literature of Russia. and the slavonic-speaking parts of the Balkan peninsula. And this difficulty seems likely to increase. The spread of vernacular education has outrun the cosmopolitan organization of learning for a long time to come; and learned

societies will have to take account of that. Even the obstinate and regrettable refusal of young England to learn German will have to be met for a while by more ample provision for translations and systematic abstracts of German work. Now, all this points to increased reliance on what I may group together in a phrase as "the learned man." He will not be as of old, *homo unius libri*, but he will be a specialist all the same, and it is my impression that, increasingly he will find his own opportunities of public service in connection with societies and libraries and map rooms like this; and an important part of his training, in the preparation of monographs, perhaps even commissioned by the headquarters of an institution like this, such as have come to us already from time to time. It is by some such policy as this that we can best justify here the confidence which the country has expressed in our work, by increasing our Parliamentary grant. Organized knowledge the country must have. Some of this it will have to get as it can, and for this it must rely upon the intelligence of its permanent Civil Service to know what it needs, and ask for it in time. Some it can best provide through the learned staff of special knowledge-getting institutions, like the National museums and surveys. But there is much that will be provided more spontaneously, more cheaply, and (I believe), under British conditions, no less efficiently, by reliance on large voluntary agencies like the Royal Society and our own Geographical Society, and, by putting sufficient public recognition and public aid at their disposal, to ensure that their goodwill and instinct for public service finds adequate opportunity to act.

It is to my mind the best of omens that a substantial increase in the Government grant comes so nearly at the moment when the Council sees its way to resume direct management of its department of research; and I share the confidence that we must all of us feel, that the research work of the Society will deserve in the future even larger recognition.

After the paper, Sir DAVID GILL: I am afraid I am not sufficiently widely read as a geographer to criticize or discuss what has been so well put before us in a broad sense. For my part, I venture to think that the subject has been tackled a little largely from the historical, to the exclusion of what I should like to call the mathematical, side of geography. To me, though it may appear strange to your mind, that is the most interesting part of geography. I think we should not insist too much upon how far geography can be defined as a science. In one sense all knowledge is science (*scientia*), and geography in its modern and in its really only valuable sense, utilizes every science, and gives us a large amount of freedom, at least in this Research Department. I should object entirely, of course, to a specialized botanical paper, or to a specialized chemical or specialized geological paper; but the bearings of any geographical fact upon those sciences are legitimate and proper things for our discussion. On the other hand, that part of geography which most interests me is in the unhappy condition of having no society that represents it. The Astronomical Society have, to a greater or less extent, said "geodesy is apart from us." They have made a bow towards geodesy in appointing Prof. Etvos as an honorary member of the society purely for abstract geodetic considerations; but, generally speaking, they tell you that geodesy is not its province. If geodesy does not

belong to the Royal Astronomical Society, it surely must be the business of the Research Department of the Royal Geographical Society to take up geodesy, for after all geodesy is the foundation of all accurate geography. By confining papers on geodesy to the Research Department we should not bore the great majority of the members of the Society, for the great majority of members of the Society are not interested in the subject, and certainly we do want somewhere in Britain where papers on that subject can be discussed. The Society of Surveyors has to some extent dealt with elementary forms of geodesy, and, without going further and taking up your time, I should just like to put forward the view that geodesy should be one of the subjects which comes specially within the range of this Research Department.

Captain Lyons: While the activity of this Society extends to the whole range of geographical science, I am convinced that the Research meetings of the Society will inevitably tend towards the detailed discussion of more specialized portions of it; and that such discussions are vitally important to the proper advance of the subject. Descriptions and observational material accumulate so rapidly that we seriously need a great deal more of that specialized work on small portions of the subject. I fully support Sir David Gill's opinion as to the necessity at the present time for giving all the attention we can, not only to geodesy, but also to secondary work in surveying, and particularly to scientific cartography. But little has appeared on the subject in this country, and it needs working up from a systematic point of view, not only by the draughtsman, but also in co-operation with the geographer. I am not at all clear we have yet got the best form of expression in our maps for special regions; desert regions, tropical forest regions, and others need special treatment. I look forward to a very much extended sphere of activity in this portion of the Society's work, and I hope the Council of the Society may see its way to assist those who have shown evidence of good scientific work on sound lines before these meetings, enabling them to go further and carry out their work in various portions of the globe. It is one of the disadvantages in geography that a large amount of work cannot often be done in a restricted area, but travel is needed in order to become acquainted with the wider aspects of the subject, and in this direction the Society can greatly promote the development of scientific geography in this country.

Dr. A. Strahan: I came here to listen rather than to join in a discussion, but I am glad to have the opportunity of expressing the pleasure with which I have heard the Chairman's brilliant address. The old question has been revived of the boundaries of geographical science. So far as regards geology and geography, I am sure that a definite boundary does not and never will exist. There never can be any hard-and-fast limit between the two, and the more they overlap the better for both. There is a wide field of research in which geographers must co-operate with geologists. The Chairman alluded very kindly to our investigations on rivers. I should like to say that such credit as is due is not due to me, but to those who have co-operated with me in this investigation. We formed a committee, as you may remember, consisting of Dr. Mill, Dr. Herbertson, and myself, which Mr. MacKenzie subsequently joined. But there are others who have done a great deal of work. I may say that the bulk of the work has been carried out in the case of the Exe by Mr. Mackenzie, Mr. Elton, and Mr. Beckit; in the case of the Medway by Mr. MacKenzie; and in that of the Severn by Dr. Woollatt and Dr. Owens. I believe that, when the results of Mr. Mackenzie and Dr. Owens are laid before the Department, they will throw much light on the problems of keeping the records of a river and of registering the rainfall over the river-basin. That, I hope, may be in the course of the next session of the Department. With respect to the suggested

duties of Chairman of this Department, I should hardly expect any one to be able, on the spur of the moment, to sum up the results of our long and detailed discussions. Would it not rather be his place to organize and guide the discussion? It would be difficult to get a chairman capable of such a duty as has been suggested.

Sir DAVID GILL: Is not the argument that there were to be a variety of chairmen?

Dr. STRAHAN: Yes. But does not that rather increase the difficulty? I will merely conclude by thanking Dr. Myres for the brilliant address with which he has concluded this period of the existence of the Research Department.

Mr. A. R. HINKS: I was very glad to hear Sir David Gill's claim that geodesy should acquire some more exact domicile than it has at present. We have at the Astronomical Society tried to be brotherly towards geodesy; we have had from time to time geodetic papers like those that have come from India; our Annual Report has included accounts of the Geodetic Survey of South Africa, and other important operations. But we fully realize that the Astronomical Society is not really the proper place for the very large and important part of geodesy that is more immediately concerned with being the basis of map-making. As to what Captain Lyons has said as to the necessity of scientific cartography, it has struck me of late years that we do particularly want to have some place where experiments in cartography can be made. The official cartographers of the Ordnance Survey and the War Office have in recent years made excellent improvements, and done a very great deal of what is more or less experimental; still it would be a splendid thing if there were some means of trying more experiments, which are necessarily costly, and which are not at all provided for at present, I think. If it were possible to have at one's disposal a sum of money which could be employed in making experiments in cartography, say under the guidance of Captain Lyons, who has so many ideas on the subject, I think it would really be a most valuable piece of work for the Society.

Prof. L. W. LYDE: I have very little to say, except to express the pleasure with which I listened to the President's address. I think that all who heard it must have been delighted both with its substance and with its form. As to the Department, I am personally less interested in geodesy than in finger-prints. It is to me profoundly interesting that all round-headed people seem to have a great predominance of round finger-prints, and all oval-headed people to have a predominance of oval prints. And my own special difficulty is my slight acquaintance with any language except modern English and classical Greek. And I can't resist the temptation to take advantage of this opportunity to ask for information from any one who has, or can get, it about such things as these prints, or the extent to which Mongol babies have prehensile fingers. This is not a mere squib. Surely proof of normal prehensile power would be proof that these grasslanders are still fundamentally arboreal primates, however far they may have moved from the arboreal control in their obvious somatic qualities. I might add that even my knowledge of English was not equal to detecting in the word "mouse-hole" the presence of a "barrow," which the more advanced people of the district called a "maus-ō-leum," with the accent on the *o*.

Prof. HERBERTSON: There are only two points of the many raised by Prof. Myres which I shall discuss. One is the difficulty we geographers have because our units are so large and complex. This makes it very hard for many people to see that there is a unit at all, and further to realize that it is only by scientific procedure that we can analyze the different elements of this complex unit with sufficient precision. To form a true idea of the whole geographical entity, we have to adopt every possible notation—cartographical, mathematical, pictorial, and literary—which

can be of use in characterizing it. It is very important, from a practical as well as from a theoretical point of view, that this complex geographical unit should be recognized. While theories of heredity are slowly being altered, so, I believe, are ideas about environment. We feel that environment is not a dead thing, but something which is really alive and constantly altering within limits. Its changes, seasonal and secular, are not merely physical, and it varies in the way in which different parts of it become related to the human part of it. A very obvious example is that of Central Canada, where one human stock has replaced another, and is related to the Central Canada geographical entity in a different way from that of the older stock. In our own island different aspects of the same geographical region have to be emphasized in stating the relations of different generations of the same race to it in the twentieth, the eighteenth, and other centuries. One of the tasks of geographers is the examination of this changing value of the environment, in addition to the study of the different characteristics of the different types of environment.

The second point is this, I have been looking through the applications for a studentship in geography, and find that there are a number of teachers in this country carrying on small pieces of useful research work who could very profitably be helped by small grants from this Society. Teachers of geography who are doing good work in schools and attempting original work for themselves, should be encouraged to send an account of their work to the Society. The Research Committee, which is to exist in the coming year, should examine these, and in certain cases recommend small grants which would not only help those teachers to carry on their research work, but give them invaluable encouragement.

Prof. MYRES: Our time is nearly run out; the best of all reasons for not detaining you longer. I wish to thank those who have taken part in the discussion for the suggestions they have made. Overlap between our work and that of other societies is inevitable, and I have been impressed with the number of papers presented at other societies which would have been suitable for meetings like ours, just because the point of view from which the subject-matter was regarded was at bottom a geographical one, and seemed to deserve a more expertly geographical audience than it received. After all, the essential matter is to see that there are no gaps. Overlapping matters comparatively little, and that is why I am sure all members of the Department are at one in recognizing that mathematical geography, which is in a homeless and outcast position otherwise, should be represented here amply and fully. This alone can give us an accurate framework to build our other distributions upon. The same applies also to another point, the extension and improvement of our geographical symbolism. A great deal has been done in the past to get agreement upon what I might broadly describe as a geographical alphabet, but the things to be described and denoted are always running ahead of the symbols which are in use. That is clearest in regard to some of the simpler complexes like the surface vegetation. I remember a remark made by a distinguished geographer at one of our meetings, on seeing on the screen some distribution-maps for which I was responsible, that he supposed anybody was free to colour any map as he liked! That, of course, is true, but it seems to me very desirable that when people put colours on maps they should use such colours as would convey their meaning promptly to the people who are there to see them: and so with other symbols too.

I thank you for the way in which you have taken up the points I tried to raise.

A JOURNEY IN SOUTH-WESTERN ABYSSINIA.*

By GEORGE MONTANDON, M.D.

A BRIEF historical retrospect will recall the journeys hitherto made in the south-west of Abyssinia—that is to say, in the triangle whose angles are at Addis Abbaba, Lake Rudolf, and Nasser, and whose sides are formed by the string of eastern lakes, the Akobo and the Baro.†

The network of routes followed may be grouped under three main currents of exploration, viz. (1) the old travellers: d'Abbadie (1843), Cecchi and Chiarini (1880), Soleillet (1883), Borelli (1887–1888), and (more recently) Mylius and Bieber (1905), who have started from Shoa and, taking a south-west course, have reached Jimma and Kaffa without passing beyond. (2) Others (and these have been the most numerous during the last twenty-five years) have, since Teleki's time (1888), completed the exploration of the Lake Region, starting either from Addis Abbaba or the Indian ocean. They include Donaldson Smith (1895 and 1900), Bòttego (1896–1897), Cavendish (1897), Darragon (1897), Macdonald (Austin) (1898), Wellby (1899), Leontieff (1899), Wickenburg (1901), Erlanger (1901), du Bourg de Bozas (1902–1903), Maud (1903), Brooke (1903), Gwynn (1909). (3) A third group is formed by those who, coming from Lake Rudolf or Addis Abbaba, or ascending the Sobat, have followed the Akobo or the Baro and traversed the lowland between these two rivers; they are: de Bonchamps and Michel (1897–1898), Faivre and Potter (1898), Bòttego (1896–1897), Marchand (1899), Wellby (1899), Austin (1900 and 1901), McMillan and Jessen (1904).

It will be seen from this that the portion of the Ethiopian plateau comprised between its south-western escarpment, the right bank of the middle Omo, and the left bank of the upper Baro—*i.e.* the centre of the triangle in question—is still relatively little known. It has been traversed by Bulatovich (1897), Faivre and Potter (1897–1898), Neumann (1901), and later by Gwynn (1909). The country of Gemira in particular, which has not hitherto been the object of special investigation, and was the goal of the journey now to be described, had been crossed by the three first of these travellers only.

Starting from Marseilles at the end of October, 1909, and landing at Jibuti, we reached Addis Abbaba in December. Here our journey proper began, and after we had first provided ourselves with the imperial safe-conduct, an indispensable requisite for long-distance travel in the interior, we left the capital on March 1, 1910, taking the south-western

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* Map, p. 468. See also *La Géographie*, "Le Ghimirra," with sketch-map (January, 1912); and *Le Globe*, "Traversée du massif éthiopien: Etude comparée des zones parcourues;" with coloured sheet (June, 1912).

† No account is here taken of one or two recent journeys, respecting which not even a sketch-map has been published.

route for Jimma. The approach of the rainy season made it necessary to do the first stages at a rapid rate, and we therefore hired mules as far as Jiren, the capital of Jimma, where we meant to make our final arrangements for the march. Another consideration led us to make the best speed we could at this stage: viz. that we had to measure the base, which was to serve as the foundation of our topographical work, as far in advance as possible, almost in the middle of our itinerary.

Two principal tracks lead from Addis Abbaba to Jimma, the northern being the more frequented. It takes the line of high ground, and is obligatory during the rains; whereas, travelling in the fine weather, we were able to follow the other, more to the south. The path leaves the vast cirque in which Addis Abbaba lies, by the little pass of Deletti, and descends into the plain of Hawash. The landscape here presents the same poverty of grass and colour as has been familiar to us on the Abyssinian plateau from Balchi onwards, and which continues up to the distant crests which close the horizon. There are no large villages, only here and there groups of Galla huts, each flanked by a few low-growing tobacco plants. On the sixth day the road leaves the basin of the Hawash and enters that of the Omo. The saddle which separates the two basins is wide and irregular. From the top of the slope on the far side another plain stretches out, traversed by two parallel affluents of the Omo, the Walga and the Wabi. Its appearance is very different from that of the Hawash. The latter formed a single expanse, but the plain before us consists of a series of undulations, and the watercourses have furrowed it deeply. Moreover, it is covered with vegetation; not with dense forest, but with trees and shrubs which from a distance give it the appearance of a vast orchard—the so-called "park-landscape." On the Hawash the soil is blackish, here it is of a red-brick colour. From the Hawash the path rises by a very gradual incline; it drops again more rapidly, in places by irregular stairs, over huge rocks which give no foothold to the mules in the wet season. At the foot of the slope the track crosses a strong stream—the Laga Riebu—flowing through the district of Wolisso. Hence to the Omo the journey occupies two days, the path following a level course between the Wabi and the Riebu.

Of all the maps we have consulted, Darragon's is the only one which marks the last-named watercourse ("Rébou").* However, having crossed it at right angles without following it, he shows it as falling at once into the Walga. In reality, after receiving numerous streams from Mounts Maru and Dandi, it maintains an independent course of 40 miles before joining the Walga, which, though more copious, hardly surpasses it in length. The plain between the Wabi and the Walga was formerly uninhabited, serving at most as a hostile meeting-ground between the Galla from the north and the Guragwe from the south. It can now show some cultivation and settlements. In its lower course the Riebu separates

* *Comptes rendus de la Societé de Géographie de Paris*, March, 1898.

the two races; the high ranges which form the framework of the Guragwe country bounding our route at some distance to the south-east, while the mountains of the Mecha country close the horizon at a less distance to the north-west.

Reaching the banks of the Omo, we have an imposing view before us and at our feet. We are at the very angle of the stream, which, coming from the west, makes an abrupt bend to the south. We are some 1800 feet above it, on the edge of the plateau which forms its left bank. A terrace of the same height faces us on the right bank, resting against a group of peaks which rise at various angles. The gap between the two escarpments, which has been cut out by the action of the river, is about 6 miles wide, and the slopes on either side consist of a talus of earth and rocks; on the right bank the characteristic form is the sugar-loaf. Rocky cones shoot up, it may be, from the floor of a coombe, from the flank of a mountain, or even from the plateau itself, to the height of 700 to 1000 feet (Tulu Ali, Tulu Derar, the two Tulu Kobijo, etc.). Below the bend the banks approach nearer, and are formed of sharp peaks rising irregularly one behind the other into the blue distance. The whole scene is one of sublime chaos.

The path drops rapidly to the river, where the valley flats form a desert over which broods a heated stagnant atmosphere. In spite of the dry season the stream has a powerful current, but its water is turbid, and tastes like stale fish. Above, it opens out into basins inhabited by hippopotami and crocodiles. During the rains, when the volume of water is perhaps increased tenfold, filling the whole valley-flat, there is no possibility of fording it. Two or three miles higher up, a native bridge is being built, or rather rebuilt, at the orders of Abajifar, Governor of Jimma. Formerly, the Omo was crossed during the bad season by means of primitive canoes and rafts. The construction of the bridge meant a loss of revenue to the chief who commanded the passage. He therefore had some huge tree-trunks thrown in, and away went Abajifar's bridge down-stream. The ascent on the far side is as steep as was the descent. Arrived at the edge of the plateau, one passes a barricade made of cut branches and green trees intertwined, by a gate of native fashion hinged on its upper edge, which is raised by day, but let down at night. This is the "kella" of Abalti, a customs post of the province of Jimma. Each province has its own customs station, and the Galla term *kella*, signifying gate, is generally employed by the Abyssinians, and even by Europeans, as the designation of these posts. The plateau of Abalti, of no great extent, is covered with short dry grass. At its edge rises one of the characteristic sugar-loaf peaks, the Tulu Derar.

Leaving our caravan here, we descended again to the Omo to hunt hippopotami, the narrowness of the stream and the aid afforded by the workmen engaged on the bridge rendering the task easy. Climbing once more to the *kella*, we left the plateau and proceeded along a mountain

track skirting the deep ravine of Kaur. This track passes the market of Kumbi, crosses the steep-sided ravines of Kacha and Sinnini, and approaches the Gibbe at a point where the Onkure rivulet enters it by a fall 50 feet high; the Gibbe itself forming a considerable fall, 100 yards wide at high water, half a mile above. This fall has a horseshoe shape and a height of some 60 feet or more. Above is a basin of calm water in the midst of a thick forest, and the whole presents a fine effect. These two falls mark the entrance of the Gibbe into the deep gorge, which it traverses until its junction with the Omo.

Beyond the Gibbe, the ground presents only gentle undulations, the horizon being bounded on the right by several ranges running at right angles to the course of the Gibbe, on the left by the bare massif of Janjero, and the wooded one of Garo. The central summit of the latter, Gudo, is the highest mountain met with by us during our whole journey through the southern provinces, reaching a height of some 11,000 feet. The Bulbul, a winding stream, is soon crossed. Just below the ford there is a saline spring in the very middle of the current. The natives have built a dam round it and bring their herds to it from long distances; the banks of the stream are thus constantly lined by bellowing troops of cattle. Two days later the track crosses a line of hills running north and south, which forces the Gibbe to describe a curve to the south. Jiren, the residence of Abajifar, is on the range; Mendara, Kotyi, and Hirmata lying on the plain beyond. Hirmata is the great market of Jimma, the most important, in fact, of the whole south-west of Abyssinia. The market is held on Thursday. As elsewhere in the Galla countries, hides, wax, coffee, ivory, and caoutchouc are the articles of export with which the representatives of European commercial houses (which have here their most remote agencies) concern themselves. Among the minor articles appealing rather to the amateur the most interesting are the baskets, woven in great variety of colour and design, and the small wooden receptacles for butter.

For us, too, Hirmata formed an important stage. We here provided ourselves with the necessary animals—twenty-three donkeys for the baggage and four riding-mules—and completed the roll of *askaris*. Those engaged here were Mussulman Galla, who, less assuming and knavish than the Abyssinians, perhaps because less spoiled by intercourse with the whites, gave us every satisfaction in fair and foul weather alike. On the morning of March 31, the caravan being ready to start, a compatriot galloped up with the news of a revolution at Addis Abbaba, and the imprisonment of the Empress, adding that he did not know whether to advise us to start or to remain. It was a difficult matter to decide, for though the event itself was not unexpected by those acquainted with the domestic crisis in Abyssinia, the ultimate results were not easy to forecast. We therefore decided to make a short trip into the neighbouring valley of the Gojeb—still a little-known wilderness. Besides being useful in itself, it

would give us an opportunity of judging of the effect exercised by the political news on the population.

Taking no tent, and with three mules only, we crossed the mountain range which separates the Gibbe from the Gojeb, passing between two summits known indifferently from a distance as Lalo—a name given also to the pass between them. It may not be out of place here to make some remarks on the manner of bestowing place-names in this region—a subject of psychological as well as geographical interest. Apart from a few populous centres, the dwellings of the Galla are collected into small groups scattered over the cultivated lands. To the inhabitants it is the areas of cultivation, delimited by watercourses, the relief of the ground, uncultivated stretches, or forests, which correspond to our place-units and possess each a name. The brooks and small rivers often have no special names of their own, but take those of the lands they water. Along their courses they thus eventually take several names. Such land as is occupied neither by houses nor cultivation lacks interest for the native and bears no name. This is the case with forest-clad mountains, apart from a few summits which strike the imagination as well as the eye, and are designated by the prefix Tulu or peak. The name which a native will give you for a mountain you point out to him at some distance is that of the lands at its foot or on its flanks, and not the label by which we Europeans refer to its abstract form. Thus, Lalo—merely one instance out of many—belongs strictly to the last large group of cultivated lands, at the foot of the forests which crown two mountain massifs. The inhabitants of Lalo—apparently in disagreement with those of the bottom of the valley—call their lands by that name; for the neighbouring summits they have no names, and different individuals give such different names that they might seem invented on the spur of the moment to satisfy their questioner.

The forest which we entered on leaving the Lalo fields is composed at first of a tangle of trees of all sizes, but these in time give place to bamboos, which at last monopolize the whole ground, allowing no grass to grow beneath them, so that we had to cut them down to feed our mules with their tops. The track is not made for beasts of burden, and one has to use the hatchet at every step. There is no escape, but still a journey of two days through a bamboo forest at nearly 10,000 feet is picturesque even in its uniformity. We suddenly leave the forest and a grand prospect lies before us. The path has reached the extremity of the spur that it has been following, and this ends in a steep pyramid-shaped face, which falls, so to speak, in cascades of terraces to the river 4000 feet below. The southern slope of the massif presents a series of similar pyramidal faces, separated by transverse gaps. The forest ceases everywhere at the upper margin of these spurs, and the slopes which face the Gojeb are bare, covered with dry grass or widely scattered shrubs. The southern bank of the Gojeb, forming the province of Kaffa, is visible for a long distance. It presents an equally striking prospect of savage wildness.

UPPER COURSE OF THE HAWASH RIVER.

MEETING-PLACE OF THE OMO AND GIBBE RIVERS.

THE GIBBE FALLS.

THE GOJEB RIVER.

That which gives its peculiar stamp to the Ethiopian massif—as has been remarked by various travellers or is to be gathered from their descriptions—is not the mountain peak as in our Alps, but the crevasse—the abrupt and profound incision. This results from the concentration of the rains into a small space of time, and the violence of the streams during this short period. It is true especially of the northern part of the area—*i.e.* in Abyssinia proper, where the rains are more violent but of shorter duration than further south. But the profound intrenchment of the Omo and Gojeb prove that it holds good also, though in less degree, of the Galla countries.

The descent was a ludicrous affair. There was no question of staying on one's mule, and one feared each moment to see the baggage animals making a glissade into the Gojeb. This is the way in which roads are conceived of in Abyssinia. Instead of making for a depression by a transverse valley, they keep as long as possible on the heights and then drop to the valley bottom by a giddy descent. Even the main arteries are usually constructed on this plan. On the other hand, where we should expect to find them following a straight line, the tracks often take the most meaningless zigzags. Consciously or not, man goes out of his way to render difficult the passage of a country in which Nature herself has been unusually lavish of obstacles. The Gojeb reached, we followed it downwards. The track had now ceased entirely, and in places our rate of progress was less than a mile an hour. Once or twice we met with slaves in charge of meagre cotton plantations, and here and there we came across antelopes or the traces of buffalo. Our party followed the Gojeb until it struck the track leading from Konta to Jimma, whereupon it made its way back by this across the mountain range and bamboo forest, emerging into open country at the *kella* of Garrima. We were back at Hirmata nine days after leaving that place.

Supplementing the observations made during this trip by information collected from the natives we obtain the following facts. The passes which cross the mountain range separating the Gibbe from the Gojeb are, from west to east—

1. Beletta, the main line of communication with Kaffa.
2. Marti, impracticable for laden animals.
3. Lalo, practicable, at a pinch, for beasts of burden. The last two routes lead only to the Gojeb, which they do not cross.
4. Deddo-Garrima. This bifurcates after passing the *Kella* of Garrima, the western branch leading to Konta, the eastern to Kullo. Both are practicable for laden animals, as is also the next.
5. The Mansho-Kullo route.

Of these only the Beletta-Kaffa and Deddo-Garrima-Kullo routes cross the Gojeb by bridges (of native construction).

East of the Mancho-Kullo road there are probably paths for pedestrians, but they will be of merely local importance. The first main road in an

easterly direction is that of Omo, which takes its name from the cultivated lands of Omo in Jimma, on the slopes of the Garo massif, by which it passes. It crosses the Omo (without a bridge), and leads to Damta, Tembaro, Wallamo, and the Arussi country. Apart from a few plantations of native cotton, the valley of the Gojeb has neither cultivation nor inhabitants. Not a path, however primitive, follows either of its banks.

The latest news from the capital proved reassuring, so the caravan made its final start about the middle of April. It crossed the Beletta pass, left the main Kaffa road on the south, and proceeded westward, in the low-country of Gera, as far as the hot springs of Kecho. In regard to these, it is interesting to note how observations may vary after an interval of thirty years. According to Cecchi the water of one spring was milky, and had a temperature of 58° C. (136·4° Fahr.); that of the other tasted slightly of iron, and was somewhat warmer. Our observations gave temperatures of 49° and 58° C. respectively (126·2° and 136·4° Fahr.), the water clear and neutral in taste. With the passage of the Gojeb we entered Kaffa, leaving on our left Bonga, the ancient residence of the kings of Kaffa, and resuming our westward march. We took two days to reach the sources of the Dincha, a large feeder of the Omo, which had not previously been fixed. Mounts Kosha and Bonga Beki enclose a narrow and deep cirque, the slopes of which recalled the pasturages of the Jura. Three streamlets form a small marsh at the base of the cirque, and this gives rise to the Dincha, which descends the mountain as a torrent. The part of Kaffa that we were crossing displayed a luxuriant and tangled vegetation, both wild and cultivated, and was furrowed by numerous brooks.

Continuing our westward course, at four days' journey from the Dincha we reached the Wosho, whose volume appeared as great as that of the Dincha, and whose upper course, visible from Mount Kosha onwards, manifestly extends further north. Some natives told us that it fell directly into the Omo, but we afterwards saw reason to identify it with the Shiro, passed by Gwynn 16 to 20 miles lower down, and shown by him as joining the Dincha.* The Wosh, shown by Bulatovich and Bieber as a very secondary affluent of the Dincha, must likewise be identified with our Wosho. This river, therefore, must cut a profound north to south trench in the mountain mass between the Dincha and the Bako (Gelo), which is shown on the maps as a compact block.

Not far from the Wosho we had an ill-omened rencontre. We passed

* Major Gwynn (*Journal*, vol. **38**, p. 130) considered the Birbirwaha (waha = water) to be probably the headstream of the Gelo or Ghilo, but this seems incorrect. If it belonged to the basin of the Ghilo my map shows that it could only be a feeder of the Aranga, which would in this case be much larger than it is. Mr. Cowley, an English gentleman who was for three years with Major Darley (cf. *Journal*, vol. **39**, p. 282), stated to me that the Akobo is known in its upper course as the Birbir.

during the night a caravan of slaves, strongly guarded, and tied together in fours by the hands, cords being used to avoid the noise of chains. As I was returning from an excursion at the time, I fortunately had only four men with me. Had we been in force, they would probably have taken us for soldiers of the Government, and would have fired first. The track from Gemira to Kaffa sees the passage of more slaves than merchandise.

It would have wanted but little to make our entry into Gemira an impossibility. Only two days after we had crossed the frontier, all the Abyssinian posts in Kaffa—men, women, and children—were suddenly concentrated on Sherada, its chief town. Ras Wolde Ghiorghis, the then Governor of Kaffa, had been named Viceroy of Tigre, and was moving his whole establishment. Until fresh troops arrived, brigands rose on all sides, and the communications between Gemira and the capital by way of Kaffa were cut—a circumstance which deprived us for several months of news from Europe.

The *Kella* Yama, the customs post of Kaffa on this route, lies just on the water-parting between the basins of the Omo and the White Nile. At ten minutes' distance from the *kella* there is a knoll (invisible from the road), surmounted by an enormous sycamore. From this view-point, the whole of Gemira lies spread before the traveller, composed of crests rising one behind the other, until they merge in a level range which closes the horizon. This last was said by an old slave-dealer, who knew the country, to be the Gurafarda range. We shall find, on reaching it, that we have a duplication of the same view from the opposite direction. At a distance of 50 miles as the crow flies, we shall distinguish, standing out against the sky, the same big sycamore at the foot of which we are now standing.

The limit to be assigned to the country of Gemira is an ethnic one, since the province takes its name from its inhabitants, while the provincial limits established by the Abyssinians vary from time to time. We may consider, however, that, broadly speaking, Gemira as a topographical unit consists of the basin of the Bako sunk in the Ethiopian massif.*

This large river, which we heard spoken of as Mene by the Gemira of Dizu, and Owis by those of Chako, is known to the inhabitants of the country (Abyssinians) and to the traders (Galla) by the name Bako.† It comes from Kaffa, where Mounts Gidda and Gurguri separate its sources

* From Neumann's narrative in the *Geographical Journal* (October, 1902), and in the *Zeitschrift* of the Berlin Geographical Society (1902, No. 1), it appears that that writer uses the name "Gimirra" indifferently for Shoa-Ghimirra (Omo basin, fief of Ras Wolde Ghiorghis), and for Gemira proper (Nile basin, fief of Ras Tessama). It is the latter only that is here referred to.

† The precise pronunciation of this name by Abyssinians is Bak'o (short *a*, explosive *k*, the latter one of the characteristic consonantal sounds of Amharic). The name of the province of the late Dejaz Leontieff, on the left bank of the Omo, north-east of Lake Rudolf, is pronounced differently: Bâko (long *a*, simple *k*).

from those of the Wosho. For some days we felt uncertain about it, but then ascertained that it is identical with the Ghilo or Gelo of the Yambo plain of English maps, and with the Loffe of French maps. It should be noted that if the name Gelo is really that which the river bears in the desert, and is known to some few of the Abyssinians, these last, equally with the Galla and Gemira, are totally ignorant of the name Loffe. As, however, there is a Mount Loffe at the edge of the desert, and as there both banks of the river are inhabited by the Masango, who extend as far as the natural bridge of Ezgierdildil, it may be that Loffe is the Masango name for it. Generally speaking, the contact with the aboriginal population, composed, as will be shown presently, of brigands and slaves, is very superficial, and the designation which the Abyssinians have given to a locality is always to be adopted as the only one known at a distance. Unfortunately they do not take much trouble in this respect, and even important localities frequently lack any denomination. This is the more surprising that by reason of the relative insecurity prevailing in the Negro countries (Shankalla, as they are called in Abyssinia), the dwellings of the Abyssinians are not scattered here and there, but are massed in groups, which crown the steepest hills, and introduce a characteristic note into the surrounding verdure. The fact is that the Abyssinians most commonly designate a locality, or even a district, by the name of its chief, and know no other method of naming it. The huts of the Shankalla, on the other hand, are distributed everywhere in small numbers, and form no large collections.

The Bako receives three large affluents, two on the left, the Gacheb and Aranga; one on the right, lower down, the Godare. These three names enjoy the unanimous assent of both Gallas and Abyssinians.

Composed of serrated ranges, and isolated massifs deeply dissected, Gemira presents in general a severe and broken aspect, which contrasts strongly with the smoother contours of the great swelling upland of which Mocha is formed. A few summits exceed 9000 feet, while the bottoms of the main valleys lie at about 3000. The "katamas," *i.e.* the palisaded settlements, lie in general between 5000 and 6500 feet. Apart from the eastern portion, which, thanks to its governor, was prosperous, and could show a good deal of cultivation, this scarcely reached any appreciable extent, except around the inhabited centres. The remainder of the country, although fertile, was occupied by forest. Live stock is fairly plentiful. The country could furnish, though in smaller quantities, the same articles of export as the Galla countries (wax, hides, coffee, rubber), but is still much too far from the main routes for the profitable exploitation of these. We met only a single Arab engaged in a first attempt in this direction. Nor is there any native market, whether for the Gemira or for the Abyssinians. The traveller has often to go to the chiefs for a supply of barley for his animals, or of rations for the Askaris, and these are just the doors at which it is of least use to knock. The chase

is rendered extremely difficult in Gemira by reason of the thick jungle. During our stay a few elephants were killed by Abyssinians in the valley of the Aranga; they had probably made their way up by the pass of the Bako, coming from the Yambo desert. During part of the year malarial fever is rife in the valley-flats.

Gemira is divided into five sub-provinces, to wit: Dizu, Bennesho, Bachi, Shako, and Gurafarda; a division ante-dating the Abyssinian conquest. The immediate neighbours of the Gemira are, on the east and north, the Kafficho (it is to be noted that the inhabitants of Mocha are pure Kafficho); on the north-west, the Masango; on the west, the Yambo; on the south, the Shuro; and on the south-east, the Shoa-Gemira. If the basin of the Bako is entirely occupied on the left bank by the Gemira, it is not so on the right bank. The source itself is in Kaffa, while the right-bank affluents descend from the Mocha country, and the Bako itself, before entering the Yambo desert, has the Masango on both banks. On the other hand, the Gemira occupy both versants of the Gurafarda range, passing here beyond the Bako basin. The country inhabited by this race measures about 3000 square kilometres, and the population, as estimated by us, numbers about 20,000, though now rapidly diminishing.

To gain a clear idea of the ethnological position occupied by the Gemira type, we must cast a rapid glance at the fundamental facts of the ethnic history of Ethiopia, which may be divided into four periods. Whereas Africa was occupied at the dawn of history by three races: the Negro in the north, the Negrillo or pygmy in the centre, and the Bushman in the south; Ethiopia then fell within the domains of the Negroes, who occupied chiefly the valleys and lower grounds. A little later a race of different origin established itself on the plateau. This period may be styled the pre-Hamitic.* The second period is determined by the invasion of the so-called Hamitic race, which, coming from the north, spread itself over North and North-East Africa. The branch of this race which then invaded Ethiopia is known as Cushitic. The Cushites, driven back by later invasions to the outskirts of the plateau, form to-day a broken fringe round its border, composed of varying elements. Of these the most important are the Danakil, the Shoho, the Bogos, the Agau, the Kafficho, the Wallamo, and the Sidamo. Here and there the Cushites and the Negroes become fused, and this mixture produces, especially in the south-east of Ethiopia, various peoples, among whom the Gemira are to be placed. While the third period is marked by fresh Hamitic and by Semitic invasions—the Semitic representing a new element, numerically inferior, but superior in point of culture—the fourth or more modern

* Some authors see the descendants of the primitive population in the pariahs distributed in small numbers throughout the country, and living solely by the chase—whom the Abyssinians style Waito, the Gallas Manjo, and the Gemira Kwayegu.

period was inaugurated by the invasion of the Hamitic Galla, who, pushing southward in the sixteenth century, spread themselves fan-wise over Southern Ethiopia. These two periods have no present interest for us, since the peoples and races that they brought have no part in the formation of the Gemira type.

The accession of Negro blood that is to be traced in the Gemira is not Bantu but Nigritic. The position occupied by this stock, enclosed between the Kafficho on the east, and the Nigritic peoples (Masango, Yambo, and Shuro) on the west, renders this fact probable *per se*, and it is also proved by other lines of reasoning.

Large of stature and well-knit, the Gemira have a vinous-chocolate tint of skin, darker than that of the Kafficho, but lighter than that of the neighbouring Nigritic peoples. The emphasis of the Negroid characters goes hand-in-hand with the depth of tint, and the Gemira are nearer to the "Ethiopians" than the neighbouring Negroes, though there are strong individual differences. The character that perhaps most distinguishes the Gemira from the Nigritic peoples bordering on their country is the nature of the hair. As with the Cushites, the Galla, and the Semito-Hamites, it is frizzled, but distributed evenly over the head, whereas in the case of the Masango and Shuro it is sprinkled "en grains de poivre." It seemed to me besides that, in the case of some individuals, it formed a link between two types: although spread evenly over the head, it still presented a growth of denser tufts.

It is not possible here to discuss the deductions to be drawn from the anthropometric data obtained, but one is justified in affirming at first sight that the Gemira constitutes a "type." The outcome of the crossing which took place in distant times soon became crystallized. For centuries the Gemira have lived a life apart, without appreciable contact with the neighbouring peoples, and have maintained their acquired characters.

As with all primitive peoples, the Gemira have customs peculiar to themselves, which are displayed in external traits of which the principal are as follows: Every infant suffers vertical incision on the root of the nose. The men bear on the forehead a broad cheloidal tumour lined with vertical furrows, due to the fact that when a relative dies they strike their forehead with the blade of their lance. A large number both of men and women have their chest and back covered with tattoo marks, formed of simple cicatrices produced by punctures or cuts. The usual device is a triangle. The hair is cut in a singular manner; the head is divided into compartments, and displays varying designs from the different lengths of the hair in the several compartments. Among the ornaments worn, those on the ear attract the most attention. They are either pendants—of which some have the form of a double spiral and are identical with those met with in the lake stations of the Bronze Age— or take the form of plates of ivory, discs of wood, or plugs of dried grass, inserted *into* the

ACCRETIONARY PYRAMID WITH HOT SPRING ISSUING FROM TOP.

NATURAL STONE BRIDGE ON THE BAKO RIVER.

GORÉ HILL FROM THE ABYSSINIAN GOVERNOR'S HOUSE.

GRASS-COVERED HILL ON THE RIGHT BANK OF THE DIDESSA.

lobe of the ear, which is distended to its utmost capacity by months or years of preparation.

A Gemira's requirements in the matter of clothing are strictly limited, but he never goes quite naked. Men and women wear around the loins a few rows of beads on a strip of leather from which depends in front and behind a piece of dirty cloth, or even a small leafy branch. The married women encircle their loins with a skin. In case of rain the Gemira, like the Kafficho, throw over their shoulders a thick cloak made of long dried grass and falling freely down to the haunches.

The huts are very small, and their steeply sloping roofs terminate in a sharp point. Their inmates sometimes paint on their huts, by means of coloured earths, the figure which seem to be their favourite if not exclusive design—the triangle.

No fewer than four languages are spoken in Gemira, of which two are more important than the others. A number of terms and phrases of one of them were collected, and were submitted to Prof. Carl Meinhof, of Hamburg. This well-known specialist in African languages reports briefly, on the basis of a comparative study, that the said language is formed of Hamitic elements on the one hand, Sudanese on the other. In any case any relation with the Bantu languages is out of the question. The Gemira are pagans. They appear to believe in a divinity inhabiting the sky—not to be identified with the Wak of the Galla—but also in secondary genii dwelling on the Earth.

In Ethiopia, each of the groups of peoples has its corresponding social status. If the Abyssinian is master everywhere, one may say the Galla is a domestic, the Kafficho and the Wallamo a serf, and the Gemira, like the Negro, a slave. Slavery is no tofficially recognized, but it exists in fact, though with some extenuations in form. The slave is not free to change his master, he is put in chains if suspected of an intention of escaping, he is beaten if he does not work or march at the will of his master; and for all this he receives no pay. On the other hand, if he can be "presented," he cannot be openly sold, and must be designated *gabare* ("subject"), not *baria* ("slave"). Even these differences disappear in distant provinces like Gemira, and in times of disorder. Many times did soldiers or chiefs offer us their slaves, just as one might offer donkeys. Those who will not submit live as fugitives in the forests. They form but a minority, but they render parts of the country dangerous for small parties. Such is the case, for example, in the forests which separate Kaffa from Gemira, in the depths of the Bako valley, and in the territory between Shako and Shuro. Other peoples migrate in a body. The Yambo have put a distance between themselves and the Abyssinians, while the Masango have retired to the mountains and the woods, and live there in small settlements in a state of perpetual alarm. The result of this exploitation of man is that the country remains untilled and depopulated. Apart from the cultivation to be seen around the military posts, we see jungle and forest everywhere

covering a fertile soil. The native population, which we have placed at about 20,000, seems formerly to have been much more numerous.

After spending a fortnight in traversing Dizu in various directions, our caravan, 23 *Askaris* strong, and escorted after reaching the Shankalla country by half a score of Abyssinian soldiers (relieved at each garrison), made its way through the whole length of Gemira, that is to say, from east to west. We crossed the heights between the Bako and the Gacheb, leaving on the right two isolated craggy massifs, of which one is crowned by the *Katama* of Amoragadel ("Eagle precipice" in Amharic), while the other, untilled and deserted, dominates at some distance the confluence of the above-named streams. Fording the Gacheb, we passed, a mile or two further, some remarkable hot springs. To the left of the track rises what one would suppose to be a huge anthill, some 20 feet in height, of a blackish colour striped with dirty white and yellow. From its summit the spring trickles gently, having itself built up this structure by its successive deposits. A few steps further, and we see rising on the right a similar but much larger mass, whence several runlets flow down. Other hot springs are at the level of the ground, or rather of the rock.

Kuza and Kodika,* two and a half hours apart, are important as crossing-points of roads. After leaving Kodika, we crossed the Aranga, which, although the rainy season had begun, had only water enough to reach the chest. We then climbed the Gurafarda plateau—forming at the same time the limit of the province and of the Ethiopian plateau. Even at the upper levels the passage of the forest was very trying, for the rains, which had begun several weeks earlier, had turned the least hollow into a slough. On the west slope there is a small place called Badika, but it is merely a hunting station, owing its existence to the fact that the Yambo plain, which stretches in all its immensity from the foot of the mountain, provides, through its ivory, an important source of revenue for Ras Tessama.† The chief of Gurafarda has the supervision of the hunting on behalf of the Ras.

Leaving the animals and baggage at Badika, and accompanied by a few men only, I made a trip into the desert below as far as the Akobo, which the Abyssinians know by the name Kai-uha ("red water"), the Gallas as Laga-dima (with the like meaning), and the inhabitants of Golda, at its source, as Birbir. It has also been called Ajuba. We here crossed the track of McMillan, whose river Tobok must be that called Arbuka by our Galla guides, parallel to which we marched. The rocky hill that I have shown on the left bank of the Arbuka will be his "Base hill 3025."‡ The Akobo flows in a sluggish, yellowish-red

* These are Shankalla names, and are hardly used by the Abyssinians. With the exception of the three *Katamas* of Sariti, Amoragadel, and Yeki, the Abyssinians prefer to name localities after the chief residing there.

† The Ras has since died, in April, 1911.

‡ *Geographical Journal*, 1905, vol. **25**, pp. 158-171, with map.

stream—a paradise for crocodiles—between banks of the same colour. These reach a height of 6 or 7 feet, and are covered with a dense growth of trees which do not permit access to the water at all points. Quitting the Akobo we marched in a north-east direction to Tulu Lenja, and reached Badika once more. The most striking fact connected with this ten days' excursion into the desert was that we came across neither hut nor human being. The Yambo have left the foot of the mountains for fear of falling into the condition of "gabares." Game, on the contrary, is abundant, particularly hartebeest. We saw a few elephants, and killed a buffalo.

On arriving at Badika we found the animals in a deplorable condition. The donkeys, so far from filling out their sides, were dying one after another, whether from the fatigues of the last few weeks, or as a result of the bites of tsetse in the valley-floor of the Aranga. The rains were now at their height, our convoy of Askaris had by this time been reduced to one-half by return or desertion, and those who remained declared that life was not worth living in this cursed country, and that they would stay no longer. My financial resources, too, were for the moment almost exhausted. The position was thus far from inspiriting, and I was forced to relinquish my first project—a return to Jimma by Shuro and lower Kaffa, by ascending either the Wosho, so as to explore its lower course, or the Dincha. Instead, my only course was to set out by Mocha for Gore, where we should find Europeans and be able to communicate with Addis Abbaba. There was no choice in the matter.

I left no stone unturned in the endeavour to procure a few mules, sacrificing everything not absolutely necessary, and only extricating myself from the impasse by bartering a Swiss military carbine for three mules. Having now ten animals at my disposal, I could provide for the baggage, but had myself to do the 200 miles which separated us from Gore on foot. Two hundred miles in the rain and mud! Those who know anything of tropical deluges will understand what that means.

From Gurafarda to Gore our route was in part identical with that of Faivre and Potter.* The Bako is no longer crossed by the natural bridge of Ezgierdildil—a name which signifies "Bridge of God"—but a little above the confluence of the Gacheb with the Bako, and by native bridges. However, I left the caravan stationary for four days and went with a few men to Ezgierdildil, both for the sake of admiring this monument of Nature's architecture, and of viewing the spot where the Genevese Maurice Potter so tragically ended his life. The passage of the forest of Mocha, which is inhabited by Kafficho, and separates the Shankalla from the Galla, demanded eight stages—days of constant rain, and mud to make any one desperate. From Anderachi, in the heart of the Mocha country, we chose a more direct route than that followed by Faivre, who made a

* Ch. Michel, 'Vers Fachoda à la rencontre de la mission Marchand à travers l'Ethiopie,' and map (1:200,000) published separately.

long loop to the west. Some of the geographical data given by the traveller require correction. The river flowing south of Anderachi is not the Ganji, and does not turn north to join the Baro. It is the Saki, a stream which turns south and helps to form the Godare, a large right-bank tributary of the Bako. The Ganji flows due north of Anderachi and empties itself into the Baro; while the small streams which descend from the ridge of Anderachi are affluents not of the Gojeb but of the Ganji.

As if our material preoccupations were not enough to keep us at high tension, we had to put up with the most distressing of sights during the whole passage through this forest and mud-ridden Mocha. A new governor had been appointed to Gemira and was just arriving by way of Jimma and Kaffa, while the former troops were evacuating the country, taking the route for Gore through Mocha—a famished patriarchal rout driving before it the heavily laden beasts of burden and slaves. The latter were mostly Gemira, who soon began dropping one after another by the roadside, for if through his improvidence it falls out that the master is hungry, it is not for the "gabare" to eat. The corpses lay unburied, trampled underfoot by the mules or rendering the jungles pestiferous. My Askaris heard of fifty gabares lost thus between Anderachi and the Baro. And this was only the van-guard. It needs only a rule-of-three sum, and a recognition of the fact that the conditions of march became worse each day, to convince one that the Gemira slaves died by the hundred during this exodus. One can now understand how it is that the country is so rapidly being emptied of its inhabitants. A few strokes more of the pump and it will be dry, and we shall have seen the end of a race.

Gore, which we entered on July 25, marked the end of our privations, and we spent more than three months there, occupied in turn with the revision of our notes and with trips in the surrounding country or hunting parties. Lions are fairly abundant here, as the Galla do not hunt them, actuated by superstitious fear. The beasts, therefore, live on their flocks. During the rains it is possible to follow them by their tracks, but it was only after several tries that we succeeded in killing one. Situated at an altitude of 6500 feet, on a high hill which forms the last northern spur of the low ranges of Diddu, Gore is the great centre of Western Ethiopia, and its importance will go on increasing in proportion as the routes connecting it with the Sudan are developed. During our stay we witnessed the arrival of the new governor, Dejaz Kabbada, son of Ras Tessama, and could only congratulate ourselves on the excellent relations we maintained with him.

We left Gore about the middle of November. The track leading to Addis Abbaba is double as far as Yambo on the Gaba. The old one follows the telegraph posts throughout; the new one, which we took, describes a curve to the north and ascends the left bank of the Gaba—here flowing through a deep gorge. Its affluent, the Saki, forms the economic frontier between the domain of the small salt-coin *baghe* (of

which nine or ten go to the dollar of about 2*fr.* 30 or 1*s.* 10*d.*), current in Mocha, Gore, and Bure, and the large salt-coin *amule* (three to six to the dollar according to the province), the currency of the rest of the Galla countries. Between the Saki and the Dogi I left the caravan to prosecute its journey, and visited the *Katama* of Aggaro. The hill on which it is placed, to the south of our route, is noteworthy as presenting an attempt at fortification. It is an irregular plateau, measuring roughly a mile each way, and bounded on three sides by precipitous slopes and on the south only by a less abrupt depression. The whole margin of the plateau has been cut vertically so as to make an escalade impossible, while the rampart is crossed by one path only.

Crossing the Gaba at the *Kella* of Yambo, one leaves the province of Ilu-Babor and enters that of Bunno. At no great distance Mount Kaddo forms the water-parting between the Gaba (White Nile) and the Dabana (Blue Nile), and one soon crosses a grassy plain, which offers a great contrast to the luxuriant vegetation of the Galla countries. At the eastern end of this plain we encamped near the establishment of a Mussulman proprietor, Aba Abdalla, who rears civets in large numbers. He has planted avenues of trees on his property, as regular as those of Europe. It is here that a small track, hardly noticeable, leaves the road at a right angle, and leads to Guma, Gomma, and Jimma. On the right bank of the Yura rivulet a steep ascent leads to the wooded plateau which separates the waters of the Dabana from those of the Didessa, and we here enter Guma. Before dropping down the long descent to the Didessa, we pass the depression of Gombotta. This place was formerly an important rendezvous of merchants, and is therefore marked (somewhat at random) in some old maps, but it is now entirely deserted—not a trace of hut or house remains.

The Didessa is crossed by a ford. On its right bank the land of Guma is characterized by a constellation of high rounded domes, covered with tall grass. There is little cultivation, and but few hamlets or forests. The Yachi rivulet here forms the limit of the immense territories of Ras Tessama, which we have been travelling through for more than seven months. Beyond lies the small province of Gomma, well-watered, and much better cultivated than that of Guma. The aspect of the country once more recalls the Galla landscape: trees and shrubs scattered here and there over the surface hide the view. The clearing of Ghembe lies on the frontier of Gomma and Jimma. It was here that the two kingdoms formerly settled their differences by force of arms. The road rises gradually up to the water-parting between the basins of the Nile and Omo, at Dumoga, and then drops again to Hirmata, where we found ourselves among known scenes and faces.

A few days' stay in Jimma was employed in ascending the Gibbe to a point near its source, after which we returned by slow stages along our former road, to Addis Abbaba, which we reached in the middle of January,

1911. Some months were spent at the capital, and in July we once more reached Switzerland, travelling by Jibuti and Marseilles.

METEOROLOGICAL NOTES.

My results in this field have only a subordinate value, owing to the impossibility of keeping up the observations in a continuous and regular manner. They consist of—

1. Observations with the maximum and minimum thermometer, taken regularly during our first stay at Addis Abbaba. An accident to the instrument soon after we left that town made further observations impossible.

2. Determinations of relative humidity by means of the Lambrecht polymeter.

3. A regular record of the rainy days in the course of the journey.

As regards the barometer (aneroid), it was used on the journey for the determination of altitudes only.

I. *Maximum and Minimum Thermometer.*

This was suspended outside the house, which was situated near the market-place, and screened by a number of eucalyptus trees surrounding it.

TEMPERATURES OBSERVED (DEGREES FAHRENHEIT).

Period.	Minima.	Mean ditto.	Maxima.	Mean ditto.
December 23–31, 1909... ...	47·3–62·6	54·5	68–77·9	72·9
January 1–31, 1910	44·6–54·5	48·4	71·6–78·8	75·6
February 1–28, 1910	46·4–59	52	68·9–80·6	77·2

II. *Relative Humidity of the Air.*

The observations were taken with the Lambrecht polymeter. In the opposite table the observed temperatures (in degrees Fahrenheit) are in ordinary type, the corresponding relative humidities (per cent.) in heavy-faced type. In each case the means are enclosed in brackets.

From June 2 to August 21 the polymeter constantly showed a state of saturation of the air, and after August 21 I took no more observations. Nor were any taken between March 11 and 16, nor between April 1 and 9. As the instrument marked *over* 100 per cent. or a state of saturation, there is no doubt that it was out of order. In fact, when compared in Europe with a similar instrument (at the Neuchâtel observatory), my polymeter showed about 110 per cent. instead of 89 per cent.—a difference of 20 per cent. in excess. It is impossible to say *when* the instrument began to go wrong; but it seems probable that it was not before the end of April.

III. *Rainy Days During the Journey.*

Apart from a slight rain on the evening of February 27, 1910, the "lesser rains," which are expected during this month, had not made their appearance at Addis Abbaba before the date of our departure, March 1, 1910.

March 14.—First light rain, at Saja (in Jimma, between the Omo and Jiren). Repeated the next three days.

March 21.—First storm, at Jiren. Storms on the four following days, afterwards slight rains, on an average every other day.

March 29. First severe storm, at Kecho in Gera. Thenceforward severe storms every two or three days, alternating with light rain.

From this time onward we had rain almost every day. There were, however,

TEMPERATURE AND RELATIVE HUMIDITY OF THE AIR.

(*For explanation see p.* 388.)

	Times of observation.	6–8 a.m.	No. of obs.	8–11 a.m.	No. of obs.	11 a.m.–3 p.m.	No. of obs.	3–6 p.m.	No. of obs.	6–8 p.m.	No. of obs.	8 p.m.–midnight.	No. of obs.
Addis Abbaba.	Dec. 22–31, 1909	59–62·6 (60·8) **70–77 (74)**			7	60·8–65·3 (64·4) **69–73 (71½)**			4	—	—	61·7–68 (64·4) **65–75 (69)**	8
	Jan. 1–31, 1910	50–59 (53·6) **57–69 (63½)**	3	57·2–59·9 (59) **56–66 (62)**	7	59–64·4 (62·6) **56–66 (60½)**	11	61·7–64·4 (63·5) **56–66 (60)**	7	60·8–65·3 (61·7) **49–61 (57)**	9	57·2–64·4 (60·8) **51–69 (61)**	29
	Feb. 1–28, 1910	—		57·2–61·7 (59) **44–72 (56)**	8	62·6–66·2 (64·4) **55–65 (58½)**	5	66·2–69·8 (68) **54–62**	2	60·8–68 (64·4) **38–67 (53)**	15	62·6–66·2 (64·4) **41–65 (47½)**	7

The second half of February showed a marked decrease in relative humidity (about 40) as compared with the first half (about 60). This decrease was maintained in the *evenings* down to March 10, the day on which we reached the Omo.

Mar. 1–10 Addis Abbaba to the Omo	41–62·6 (53·6) **75–93 (83)**	7	—	—	—	—	86–94·1 (90·5) **27–38 (33)**	4	66·2–73·4 (71·6) **43–48 (46)**	4	64·4–66·2 (65·3) **56–59 (58)**	3
Mar. 17–31 Halt at Jiren	61·7–66·2 (64·4) **92–99 (96)**	4	68·9–77 **62–77**	2	88·7–95 (92·3) **36–42 (38½)**	4	69·8 **69**	1	69·8–71·6 (70·7) **62–73 (67½)**	3	61·7–67·1 (65·3) **74–94 (84)**	9
April 10–21 Jiren to frontier of Gera	62·6–76·1 **(68) 70–99 (89)**	6	64·4–74·3 (69·8) **80–98 (90)**	3	80·6–87·8 (84·2) **36–53**	2	—	—	69·8 **77**	1	62·6–69·8 (66·2) **64–95 (84½)**	9
April 23–29 Plain of the Gojeb (Lower Gera)	65·3–68 (66·2) **98–99 (99)**	3	80·6 **66**	1	80·6 **63**	1	—	—	65·3–66·2 **91–92**	2	63·5–69·8 (67·1) **87–97 (90½)**	6
April 30–May 11 Plateau of Kaffa (Bossa to frontier of Gemira)	58·1–66·2 (62·6) **92–99 (96)**	4	66·2–71·6 (68) **89–99 (94)**	3	—	—	—	—	—	—	60·8 64·4 (61·7) **88–98 (92½)**	7
May 11–June 2 Frontier of Gemira to Kodika (R. Aranga)	60·8 69·8 (65·3) **96–99½ (98)**	10	67·1–68 (67·1) **99 (99)**	3	74·3–76·1 (75·2) **84–89 (86½)**	2	—	—	62·6–64·4 (63·5) **88–99 (94)**	5	61·7–68·9 (64·4) **91–99 (95)**	9

several hours daily without rain, especially in the mornings, so that it was possible to continue marching and working almost as usual. From the crossing of the Gojeb on March 30, the streams were numerous and well filled.

The same conditions prevailed as far as Badika, on the western slopes of the Gurafarda, overlooking the Yambo plain, where we arrived on June 6. At Badika rain was less frequent, and during our ten days' trip over the plain (June 9 to 18) we twice had three consecutive days without a drop of rain.

The days occupied in the return over the Gurafarda and sojourn on its eastern slopes were amongst the most rainy of the whole journey. Fog was experienced on the Gurafarda, as also later on the elevation on which Anderachi is placed, in Mocha. From the middle of June onwards the rains became more irregular, without increasing in violence; falling indifferently in the evening, morning, or night, and continuing thus until the end of September. An almost entirely fine period intervened from July 21 to 29 (from the Baro to Gore). According to the people of Gore, the year was less rainy than usual.

The rains diminished markedly in October, and ceased on the 20th of that month. Afterwards, there were still a few rare storms—violent, but of short duration. The last was at Urumu, on November 23 (we had left Gore on the 19th). Then as far as Addis Abbaba, where we arrived January 11, 1911, we had perfectly fine weather, except on December 15 and 16, when we had rain (without storm) at Enkio (near the source of the Gibbe, in Jimma).

At Addis Abbaba, is is well known, the "greater rains" generally last three months (mid-June to mid-September). The downpours are very severe, and storms occur almost daily. The "lesser rains," in February, sometimes fail, as in 1910. In our case, the rains lasted six months (March 14 to October 20), but they had not the violent character of those at Addis Abbaba. Hours, or even days, of fine weather alternated with downpours, which had less the character of storms than at Addis Abbaba.

NOTE ON THE ACCOMPANYING MAP.

The map accompanying the above paper is based on the large-scale map sent us by Dr. Montandon, which had been constructed from his original plane-table and prismatic traverses by M. Maurice Borel, of Neuchâtel. Before commencing his journey Dr. Montandon placed on his plane-table all the previously fixed points that were likely to be of service to him, and as far as possible adjusted his survey to these. However, as at that time the positions fixed by Major C. W. Gwynn and Captain R. Waller (see *Journal*, August, 1911, with map) were not available, their subsequent publication has rendered it necessary to readjust Dr. Montandon's work to the framework thus supplied; but this has not altered the previous plotting to any extent. The original map was on the scale of 1: 250,000, and contained a considerable amount of detail—ethnic and political frontiers, distribution of cultivation, etc.—which could not be inserted on the smaller scale of our map. The contour interval—100 metres in the original map—has likewise been altered to 500 feet. In the extreme west of the map, in the region of the Akobo, some detail has been added from Mr. Jessen's survey during the McMillan expedition.

Dr. Montandon has supplied the following information on the method of survey adopted. The instruments used were: plane-table with telescopic alidade, by Ponthus & Therrode of Paris; prismatic compass, by the same; special aneroid for determining altitudes, by Lambrecht of Zürich; and a surveyor's metal tape. The data were completed by freehand profiles and sketches.

A base of 3770 metres was measured in the plain between Jiren and Hirmata (Jimma). Hence to the neighbourhood of the Wosho river the survey was plotted on

the scale of 1 : 100,000. In Dizu, the eastern district of Gemira, a new base of 1500 metres was measured, and this served as the point of departure for the further survey, on the scale of 1 : 250,000, as far as Gurafarda. A distant view of the Gurguri mountains supplied a passable means of joining the second section to the first. On the western slopes of Gurafarda the work started from a small estimated base, and the results were brought to the scale of 1 : 250,000 by comparison with the maps of Austin and Bòttego. On the return journey, from Gurafarda to Gore various reasons limited the survey to a traverse by prismatic compass and freehand sketches. From Gore to Jimma the plane-table work was resumed on the scale of 1 : 250,000, starting from a short base of approximately 800 metres; distances being in part estimated by the time taken to traverse them. From Jimma to Addis Abbaba the work was plotted, on the same scale, with reference to the original base. The different portions therefore differ considerably in exactitude.

The altitudes depend upon aneroid observations along the route, supplemented by the observations of vertical angles for distant points by means of the telescopic alidade. The form of the ground was sketched on the spot and afterwards brought to scale by calculation. Each altitude was calculated independently, but was as a rule determined from several different stations. The inevitable error of the aneroid is of course the weak point, and Dr. Montandon mentions that in general his measurements gave results 50 to 60 metres lower than those of other travellers, where a comparison was possible.

The following are the positions fixed by Major Gwynn and Captain Waller, to which Dr. Montandon's surveys have been adjusted:—

Place.	Latitude.	Longitude.	Altitude.
	° ′ ″	° ′ ″	feet.
Addis Abbaba	9 02 10	38 47 38	8665
Top of gibe or palace	9 01 28	38 45 47	7905
G. Furi	8 52 58	38 41 10	9185
G. Wochochu	8 58 38	38 35 35	10,975
,, ...	8 57 36	38 35 27	10,755
G. Guragwe	8 23 20	38 23 37	11,345
G. Managasha	9 02 07	38 35 15	9365
G. Boti	8 50 56	38 02 45	—
,, ...	8 51 39	38 01 34	—
G. Dendi	8 48 30	37 52 12	—
,, ...	6 57 00·8	35 39 34	8644
,, ...	6 55 22·4	35 37 50	—
Bonga Beki	7 14 14·5	36 06 47·9	—
G. Bokol	6 40 06	35 04 40	7148
,, ...	6 53 19·8	35 04 19·1	—
Jiren	7 40 35	—	—

In the north-west corner the route has been adjusted to the position of Gore as laid down on Major Gwynn's map (*Geographical Journal*, August, 1911), which agrees in latitude with Lieut. Dyé's (Marchand expedition) determination, and with that given on Dr. Montandon's map, viz. 8° 9′ N. To effect this adjustment it has been necessary to move the position in longitude about nine minutes to the west of that given by Dr. Montandon.

THE FLUCTUATING CLIMATE OF NORTH AMERICA.*

By ELLSWORTH HUNTINGTON.

Part II.—The Succession of Civilization.

In the preceding part of this article we have dealt solely with the question of whether the climate of the past was different from that of the present. Having concluded that there is strong evidence that this was the case, we shall now attempt to ascertain whether the change from the past to the present took place gradually or in pulsatory fashion, and whether its various phases synchronize with similar phases in the Old World.

Alluvial terraces are the first matter to be dealt with in this connection. We have already seen that their formation appears to indicate oscillations between dry conditions when soil and rock waste were washed down from the mountain sides into the valleys, and moist conditions when the deposits formed in the valley bottoms were dissected because the load of the streams had been diminished. In various places pottery or other traces of human occupation have been found in the terraces at a considerable depth. For instance, at Rosemont, south-east of Tucson, Mr. E. T. Vail, when digging a well for a windmill, found potsherds at a depth of 30 feet. None whatever are now found upon the surface in that particular vicinity. The depth at which they are buried is so great that neither animals nor primitive man could have carried them down from the present surface. The only possible explanation seems to be that the level of the valley bottom was 30 feet lower in the days of the Hohokam than at present, and has since been raised by alluvial deposits. In other places similar phenomena are found. For example, on one of the northern tributaries of the Gila, Mindeleff found the remains of an old canal which had been buried under 10 or 12 feet of silt, after which it was again exposed by the cutting of a new stream-channel. At present the stream has cut to a level considerably lower than that of the old surface upon which the Hohokam evidently carried on cultivation. In both northern and southern New Mexico I found similar instances where the habits of the streams have changed once or twice since the days of the primitive inhabitants. These cases are analogous to that of Olympia which was discussed in this *Journal* not long ago. At the time of the occupation of the old villages, and of the construction of the canals, the streams probably flowed at a level slightly lower than that where the pottery was found, for the ancient villages were presumably free from the danger of floods. Then there came a time, apparently characterized by aridity, when the streams were very heavily loaded with sediment. Consequently the flood plains were built up from 10 to 30 feet as the case might be, and the evidences of former

* Continued from p. 280.

human occupation were completely covered. Finally, another slight change, which we infer to have been in the direction of moister conditions, has led to the renewal of dissection by the streams. The later phases of this last process are complicated by the coming of the white man and by the over-grazing of the hillsides by his cattle with the consequent tendency for the soil to be washed away. Hence the evidence of the terraces needs to be searched with much care. Nevertheless, it appears quite certain that before the recent settlement of the country by Europeans, and after the days of the primitive Hohokam, there was an interval of considerable length, during which there occurred at least one climatic cycle involving a change from moist to dry conditions and possibly back in some slight measure to moist.

Leaving the somewhat inconclusive terraces, let us turn to the works of man. A broad view of the ruins of the south-west seems to show that they belong to at least three periods. During each of these periods the area capable of cultivation appears to have been more extensive than at present, although only slightly so in the last period. In the middle period the arable area was larger than in the last, and in the earliest still larger. The last period dates back only to Spanish times. Evidence of it has as yet been discovered in only a few places, but, nevertheless, it seems conclusive in itself, and still more so when taken in connection with other phenomena. The best example for discussion here is the ruins of Gran Quivira in central New Mexico. These ruins lie on the top of a rounded hill about 200 feet above a broad open valley draining toward the south and a mile or more in width. The altitude of the region is over 6000 feet, so that the temperature is comparatively low. The ruins consist of two distinct portions, Pueblo and Spanish, covering an area about 700 by 350 feet. All the buildings were constructed of light grey limestone broken into rough rectangles. The exact source of the material is not evident, although stone of this sort is visible in small outcrops not far away. Its character, however, is such that long and arduous work would be required to get it out in large quantities without the aid of explosives. Inasmuch as the village was evidently built long before the coming of the Spaniards, we must assume that the Pueblos, or their predecessors, put themselves to a vast amount of labour in the process of quarrying, squaring, and transporting the stones of their numerous houses. Many of the dwellings were manifestly of two stories, and the height of the heaps of rocks makes it highly probable that some were of at least three stories. The rooms are all small, as is customary in this region, the majority not exceeding 7 by 9 feet. The exact number of rooms has never been counted, but if we assume that only half of the five and a half acres covered by the ruins was actually built upon, and that the rooms, including the walls, had an average size of 10 feet by 10, there must have been about 1100 rooms on the ground floor. The upper stories may be put at 400 rooms, although the actual number was probably two or three times as great. This gives

1500 rooms as a low estimate, which would mean at least a thousand people.

When the Spaniards came to the country at the beginning of the seventeenth century, the village of Gran Quivira was evidently one of the most important in the district. Otherwise the canny Fathers would not have built here one of their largest missions. Possibly a portion of the village was in ruins, and the rocks from it may have supplied materials for the large church with walls 5 feet thick, and for the other structures which the Spaniards erected. Nevertheless, the number of natives must have been considerable. The beginning of the Spanish regime here, as in the rest of New Mexico, appears to have been highly peaceful and prosperous. Its end, so far as Gran Quivira is concerned, seems to have come at the time of the Pueblo rebellion which culminated in 1680. Since that time the site has been left as a centre around which a multitude of traditions have gathered. One tradition ascribes its destruction to an earthquake, another to a flow of lava bursting forth some miles away, and still a third speaks of a river which has now disappeared.

The truth seems to be that there is no village now at Gran Quivira because there is no water and the land is too dry for successful cultivation except in years of good rainfall. A ranch is located in the valley below the ruins, but it is not permanently inhabited, although a little cultivation is carried on. Settlers have recently taken up land 10 to 15 miles to the north, but are having a very hard time. If the rainfall is propitious they can exist, but in 1909 none of them raised enough to live on. It scarcely need be added that all depend upon deep wells for water. So far as we can gather, the Pueblo Indians, like their Hohokam predecessors, knew nothing of lime or mortar, and had no facilities for making watertight cisterns. They constructed numerous reservoirs, however, and these were their main dependence in the dry season. One such reservoir still remains intact at Gran Quivira. It lies about a quarter of a mile east of the village, in the mouth of a shallow arroyo, as dry valleys are here called. The reservoir is only about 75 feet in width and 5 feet deep. The owners of the ranch down below in the main valley say that during seven years of life here they have never seen any water in it except immediately after rain. My visit took place in the early spring of 1911, after a more than commonly rainy season. The day before I started from the railroad at Willard, 30 miles to the north, there was a heavy storm, and during the drive we were soaked in a pouring rain. Nevertheless, the next morning the reservoir contained no water, and showed no sign of having had more than a small pool in it the day before. In all the region within a score of miles of Gran Quivira there is only one permanent spring. That is located 7 miles to the west at Montezuma, and, as might be expected, it has its own ancient village. Strangely enough, however, the Montezuma village was evidently abandoned long before Gran Quivira. This suggests that the difficulty of raising crops was a more

serious matter than the difficulty of obtaining water. At Montezuma the land does not lie so low and flat as at Gran Quivira, and is not flooded as are the lowlands of the latter place during summers when the rainfall is unusually large.

In addition to Gran Quivira another similar ruin of a Spanish mission deserves mention in order to show that the phenomena just described are not isolated. This is the ruin of Buzani, about 12 miles below Caborca on the lower Altar river, in north-western Mexico. Caborca is the last inhabited place on the river. Farther downstream there is no water except during the brief season of floods. At Buzani a few Papago Indians cultivate a considerable quantity of land in good years, but do not live there all the time. They might remain through the year, for they have a well; but it is very deep, and the labour of drawing water is great. Here, as in the other case, the Spaniards established a mission in a place which no sensible man would choose for the purpose. I have not been able to ascertain the date of the Buzani church, and am not sure whether it dates from the seventeenth or eighteenth century, but probably from the latter. Its evidence is by no means so clear or pronounced as that of Gran Quivira. In both these cases the point to be borne in mind is this: we have before us two theories which stand on an absolutely equal footing as to innate probability. The only question is which one best fits all the facts. One theory is that the climate of the past three centuries has been uniform; while the other is that the seventeenth century was considerably moister than the nineteenth, and that the eighteenth century was intermediate between the other two. Viewing the two theories without prejudice, the theory of change seems to fit the facts better than the theory of uniformity. Hence we may tentatively conclude that the seventeenth century was a period of relative humidity, although both the preceding and succeeding centuries may have been comparatively dry.

The other two periods of relative moisture may well be discussed together. One of the most striking examples of an abundant population in a region now almost uninhabited is the Chaco canyon in the north-western corner of New Mexico. It lies just to the west of the wooded crest which forms the continental divide in this portion of the great south-western plateau. As soon as the wooded area is left behind one comes out upon a barren treeless plateau at an elevation of 6000 or 7000 feet, a dreary region where one may ride 25 miles at a stretch without seeing a single habitation. The only inhabitants are a few nomadic Indians of the Navajo tribe and a handful of white settlers. The Indians and a few of the white men keep sheep, while the rest of the white men, which means about one for every thousand square miles, are traders who supply the simple wants of the Indians, and incidentally make large profits. Here and there a few acres are cultivated by the Navajos, but not one family in ten possesses any arable land, and even those who have fields by no means get their main living or even a good share of it from agriculture.

It scarcely need be said that the whole region is full of ruins. As one of the traders put it after we had been talking about the extraordinary number of ruins in one of the deep canyons which transect the plateau, "I'd gamble that in any one of them canyons you'd find as many ruins as you do here." The most remarkable of the canyons is that of Chaco. In this steep-sided, flat-floored valley there are at the present time two Indians who are reasonably sure of a crop of corn each year. I saw their farms, unbelievably dreary wastes of drifting sand in the bottom of the canyon where two large branches join, and where there is consequently more water than anywhere else for 50 miles. The sand is a necessary adjunct of farming, for it is needed to act as a mulch to prevent the evaporation of the precious water. These two men between them have not more than 20 or 30 acres, if as much. Even their crops fail completely sometimes, as in 1903. During the last sixteen years, that is from 1895 to 1911, according to information given me by a trader's wife who has lived there during that time and who moved away because her husband was murdered by the Indians, the crop of all the Indians except the two just mentioned failed absolutely in the years 1902, 1903, and 1904, while good crops were raised in only two years, 1905 and 1908. During the remaining eleven years, an Indian here and there raised a scanty crop, but none of them could get a living were it not for their cattle and horses.

The contrast between the past and the present is remarkable. In the Chaco canyon or on the plateau on either side of it there are about twenty ruins of considerable size within a distance of 25 miles. Some of these, such as Pueblo Bonita, Chetwelketl and others, are strongly built, compact structures, which must have sheltered hundreds of people, and the larger ones probably had one or two thousand denizens. There can scarcely have been less than 5000 people in the Canyon and its vicinity, and I should not be surprised if the number were much larger. Whether it be 10,000 or 1000, however, matters little, for the main point is that we have here a series of strongly built, fortified villages whose inhabitants evidently cultivated a large amount of land where now no crops can be raised. These people, as appears from their pottery, their skulls, and their methods of architecture, belong to a different civilization from that of the modern Pueblos who inhabited Gran Quivira at the time of the coming of the Spaniards. They had evidently disappeared long before that date, as is evident from the present ruins of their villages, and from the absence of any hint of their existence in the early accounts of the country.

The builders of the high walls which we now see in the Chaco canyon were not the original inhabitants of the country. Digging down below their ruins one finds traces of an older occupation. Moreover, the largest villages with houses of several stories, which are now in chief evidence, invariably lie near to main lines of drainage or to places where it is clear that a moderate increase in the amount of rainfall would cause permanent streams or springs to flow. Farther away on the top of the plateau, however,

RUINS IN CHACO CANYON.

RUINS IN CHACO CANYON.

YOUNG AND MIDDLE-AGED SPECIMENS OF *SEQUOIA GIGANTEA.*

A STUMP OF *SEQUOIA GIGANTEA.* A SECTION CUT FROM THIS STUMP WAS EXHIBITED AT THE WORLD'S COLUMBIAN EXPOSITION IN CHICAGO IN 1893, AND IS NOW IN THE AMERICAN MUSEUM OF NATURAL HISTORY IN NEW YORK CITY.

far from the larger ruins and remote from any except small valleys, numerous ruins of another, more primitive type are found. They are usually small, and are greatly ruined, and seem to belong to a time long anterior to the main large ruins.

One of the best places for the study of this older type of ruins is in the Pajaritan plateau 20 or 30 miles north-west of Santa Fe, the capital of New Mexico. I was taken to this region by Mr. Kenneth M. Chapman, curator and artist of the Archæological Museum of New Mexico. Leaving the stiff shade trees of the well-watered grassy plaza of mediæval Santa Fe, we took the narrow-gauge line of the Denver and Rio Grande railroad to the lumber piles of the villageless station of Buckman on the Rio Grande river. There we were met by Judge Abbott, who since his retirement from the bench has made his home in the unique Canyon de Los Frijoles whither we were bound. Crossing to the west side of the river, we left the barren desert vegetation of yuccas, sage brush, and cacti which prevail in the river valley at an altitude of 5500 feet, and climbed a thousand feet and more to the plateau. The road winds up over variegated layers of volcanic tuff of pale pink, yellow, or brilliant orange shades, interspersed with the darker blue-black of basaltic lava-flows and capped with brick-red columnar tuffs. These volcanic rocks form the Pajaritan plateau, a gently sloping, deep-soiled region deeply cut by numerous canyons formed by streams running eastward from the Jemez mountains. On the plateau we found a beautiful district covered with forests of juniper and pinon, which at higher altitudes give place to stately yellow pines set in open order with stretches of sparse grass between them. The country was uncommonly attractive as we drove slowly along, sometimes on the level, again dropping into a hollow at the head of a canyon, and then climbing the slope once more to the upland where we could look out east or west at great snowy mountains. In spite of the deep soil, the grass and the trees, we saw no sign of habitation, for except in a few insignificant spots in the bottoms of the canyons where irrigation is possible, all the great plateau is too dry for any cultivation below a level of about 8000 feet.

Soon after we had reached the main top of the plateau we came upon the first of the great number of ruins which are scattered in every part of the plateau. These particular ones were cliff dwellings of the usual type, caves dug in the soft volcanic rock of the side of a shallow canyon, and fronted by rooms made of blocks of the same soft tufa. The number of such caves and cliff dwellings is literally thousands in this one Pajaritan plateau. With them are associated the ruins of villages like those of the Chaco canyon. After crossing several minor canyons we found ourselves at the edge of the deep Canyon de Los Frijoles, or Bean Canyon, where a precipitous cliff fell away 400 feet or more at our feet. Unhitching the horses we left the wagon on the plateau, and turned the animals down a steep winding trail, blasted in part from the face of the solid rock. We had not followed them far when I uttered an involuntary exclamation of

delight. I knew that we were to visit one of the most interesting ruins of New Mexico, but I had no idea of finding it in so picturesque a canyon. I had still less expectation of suddenly seeing far below us on a small level space at the base of the precipice a structure which at first sight suggested a Greek amphitheatre. It was the village of Tuyoni, excavated by the School of American Archæology at Santa Fe in the four seasons from 1908 to 1911. The plan of the ruins is symmetrical, a circle slightly flattened on the north side, and containing from five to eight tiers of rooms arranged like the seats of a theatre. Across the flattened end where the stage would be expected, a line of rooms contains the remnants of three circular chambers or "kivas," designed for religious purposes, apparently analogous to the larger circular or elliptical structures which are found so commonly among the ruins of adobe and wattle villages in the Santa Cruz valley and other regions farther south.

The Canyon de Los Frijoles contains not only the main ruined village of Tuyoni and several smaller ones, but also a great number of caves and cliff dwellings. Doubtless the caves were at first the chief homes of the aborigines; but as time went on and a higher stage of civilization was reached, the excavations were used chiefly as store rooms, and the main life of the households was conducted in rooms of stone plastered with mud. Often a house consisted of three tiers of rooms in front of a cave; and in many cases the rooms were built one on top of another to a height of three stories. Most of the rooms, like those of all the primitive people of the south-west, as well as the modern Pueblos, were entered through the roof. The small size of the rooms, not over 6 feet by 10 feet on an average, is surprising. The reason, however, is clear. On the high Pajaritan plateau the temperature often falls to ten degrees below zero Fahrenheit. The relatively dense population must quickly have used up all the available dead firewood for many miles around, and it was no easy task for a primitive people unsupplied with iron tools, to cut firewood sufficient for anything more than the necessities of cooking. Farther south, or at lower altitudes, the rooms were larger, for there it was easy to keep warm. The low temperature does not appear to have diminished the number of inhabitants. Frijoles canyon alone within a distance of not over a mile and a half up and down the narrow gorge, had a population of fully two thousand souls according to the estimates of Dr. Edgar L. Hewett, Director of the School of American Archæology, who was personally in charge of the excavations. The actual number of rooms, including the village amphitheatre, the caves, and the cliff dwellings, appears to have amounted to about three thousand. At the present time, according to Judge Abbot, who owns all the valley except the ruins, the amount of land that can be irrigated amounts to twenty-one acres. Manifestly the ancient Pajaritans climbed out of the canyon to their daily work, and cultivated the plateau where now not a solitary person can make a living from the fruits of the earth.

This leads us to a consideration of the older and more widely scattered occupation of the country. During our drive to Frijoles canyon we watched carefully not only for cave dwellings and villages of the Tuyoni type, but for the location of little mounds which here and there at a distance from the main sources of water, proclaim the location of houses scattered all over the plateau. One who is not closely on the watch may miss these entirely, for they are merely small heaps of stones. In the space of 7 miles we saw houses of this type within sight of the road in forty-nine different places. Inasmuch as several houses were often clustered in one group, the total number of dwellings was sixty-seven. They were obviously mere farmhouses, but some had from eight to twenty rooms, and must have been inhabited by more than one family. Therefore in our 7-mile drive through the open, park-like forest we must have found within sight of the road the dwellings of approximately a hundred families. It would be a populous farming district in any part of England where one could find a hundred families on 7 miles of road. We cannot, of course, assume that absolutely every one of these houses was occupied at one time, but it is not at all probable that any large number were vacant at a time when new ones were being built. Well-squared blocks of stone must in those days have been too valuable to permit of their being wasted when new houses were to be built. Even in these days when metal tools and explosives make it easy to quarry new stone, and when the population is much less dense than formerly, the great ruins of antiquity in western Asia are in constant danger of being utterly destroyed by the natives, who carry away the stone for use in new houses. In the days of the Pajaritans, when the blocks of stone had to be hewn with stone axes and carried from the quarries in the canyons on the backs of men, or rather of women, we can scarcely believe that the people were so extraordinarily industrious or so superstitious that they would leave good stones in ruins close at hand and go to the labour of dressing new ones. Therefore we believe that at the height of the prosperity of this region the site of practically every ruin was occupied by an inhabited farmhouse.

These scattered little ruins, almost unnoticed even by the archæologist, present one of the most interesting problems in American archæology. The potsherds found in them are of a different type from those found in the larger villages or in the majority of the cliff-dwellings immediately around them. The pottery of the farms, as Mr. Chapman points out, is almost wholly a fine-grained ware painted white and adorned with geometrical designs in black. In the larger, more modern ruins, however, only a little of this is found, while the commonest kinds are a coarser white ware with more abundant curves in the designs, and a wholly different type of red ware adorned with black figures painted with a species of glaze. These differences, coupled with other evidence such as the manifestly greater age of the small isolated ruins, show that here, even more plainly than in the Chaco region, we have to do with two occupations as distinct from one

another and from the later and far less extensive Pueblo occupation of the country, as are the modern American and Spanish occupations. The first inhabitants spread far more widely than their successors. They seem to have felt no need of being near the main sources of water nor yet of gathering together as the later people did in places which could easily be defended. For a long period before the advent of the enemy which finally displaced them, their lives were free and comfortable in their high forest homes. How or why they vanished is as unknown to us as is their origin, but perchance we shall learn the story little by little. It will not be a story of peace and monotony, for those are not the conditions which prevail when a race comes into a country, nor when it is forced out. We can scarcely doubt that stirring times took place—raids, plunder, repeated invasions, great distress and the final disappearance of one type of civilization and its replacement by another. And this painful process of a change of civilization took place not once alone, but at least twice. Formerly the cliff-dwellers who built the compact villages like Tuyoni and Pueblo Alto were supposed to have been of the same race as the modern Pueblo Indians, but now we know that this is not true. Possibly, nay probably, the modern Pueblo is related to the second or village-building type of ancient inhabitants, whom we may call Pajaritans in distinction from the still older type who may perhaps be classed as Hohokam, but the relationship is not close. The bones of the dead, exhumed after centuries, tell something of the tale. The modern Pueblo Indian is brachycephalic according to Dr. Hrdlika; his head is relatively broad, as any one can tell by looking at him. Some, however, are dolicocephalic, with long heads, but these are in a minority. The present Indians are clearly of a mixed race. Their predecessors, on the contrary, were of a pure race, predominantly long-headed like ourselves. Therefore we infer that they were conquered by invading broad-heads, and that finally the invading broad-heads and as many of the long-heads as had neither fled nor perished became amalgamated into a single race. Perhaps the ancient farmers, the mediæval villagers, and the modern Pueblo Indians were not the only races which have passed across the stage of history in the prehistoric days of America. In other parts of the south-west faint glimmerings are seen of still other cultures, which show that change and movement have been as characteristic of the ancient history of America as of that of Europe and Asia.

The dates of the three types of civilization of which we have found evidence cannot well be determined. Dr. Hewett believes that the traditions of the Pueblos may be relied upon as showing that it is at least eight hundred years since the villages of the Tuyoni type were occupied, but he attempts to assign no exact dates. One point, however, may here be emphasized. In Asia, as I have shown in 'The Pulse of Asia' and more fully in 'Palestine and its Transformation,' we have evidence which suggests that each of the chief dry epochs has been characterized by great movements of peoples. The first such movement whose date is

well defined was about 1200 B.C. At that time the ancestors of the Greeks came into their peninsula, the Hebrews entered Palestine, the Aramæans from Arabia spread out into Babylonia and all the neighbouring lands, and Egypt was overwhelmed by invaders from both the Libyan and Arabian deserts. The next great period of aridity culminated in the seventh century or thereabouts. Its approach was marked by the barbarian invasions of Europe, and its culmination by the Mohammedan outpouring from Arabia. Finally, the third of the more important dry epochs reached its climax in the thirteenth century A.D., when the hordes of Ghenghis Khan ravaged Asia from China to the Mediterranean. Beside these more intense periods of aridity there seem to have been others of minor importance, but these need not here be considered. The history of Asia during the last three thousand years thus consists of three main epochs of moist climate and advancing civilization, separated by epochs of aridity and declining civilization accompanied by migrations and wars. In comparing America with Asia it is certainly striking to find that in the drier portions of the western hemisphere we also have three main periods of prosperity and apparently of abundant precipitation separated by epochs of decline and depopulation. Perhaps the ancient farming population of America, the Hohokam, may date from the period of moist climatic conditions at the time of Christ and earlier. Their disappearance may have been due to the aridity of the period which culminated in the seventh or eighth century. Then the village people, the Pajaritans, may have flourished in the middle ages, and may have been ousted by the twofold disaster of prolonged drought and fierce invasion which would have come to America about 1200 A.D. if conditions here were like those of Asia. And finally, the occupation of places like Gran Quivira by the modern Pueblo Indians may have been made possible by the propitious conditions of relatively abundant rainfall which followed the aridity of the thirteenth century. I do not advance this as more than a working hypothesis, but as such it may suggest various lines of research hitherto neglected.

Part III.—The Evidence of the Trees.

The evidence of climatic changes thus far presented probably seems much more conclusive to the writer than to the reader. I am well aware that when the name of an author once becomes identified with a theory his fellow-workers are apt to discount his results. They know that a man is prone to find what he looks for, and that when certain facts are capable of two or more equally plausible explanations he is likely to choose in accordance with his preconceived ideas rather than according to the weight of the evidence. In searching for some method whereby this danger might be avoided, I found no success until an article by Prof. A. E. Douglass of the University of Arizona appeared in the *Monthly Weather Review* for June, 1909, under the title "Weather Cycles in the Growth of Big Trees."

Prof. Douglass there shows that the thickness of the rings of wood formed each year varies so closely in harmony with climatic conditions that it may be used as a measure of the climate of the past. Taking about twenty sections of trees from two to five hundred years of age, he made micrometer readings of the thickness of each individual ring, and thus obtained the average growth for each year. Most of his trees were yellow pines which grew in northern Arizona at an altitude of about 7000 feet in an open forest like that of the Pajaritan plateau already described. At this altitude the seasons are sharply defined, the mean temperature for January being 29° and for July 65°. Each annual ring consists of two parts. The inner portion is relatively broad, soft and white; its cells are round and well fed; and its period of growth is the early part of the growing season when the soil is still well supplied with moisture from the snows of the preceding winter and when the temperature is favourable to rapid growth. The outer portion of each annual ring is narrow, hard, red, and pitchy; its cells are lean and emaciated; and its period of growth is the later part of the growing season when the soil is dry or when the temperature falls low on the approach of winter. Occasionally a double ring is formed, but this is rare and can usually be detected. Except where low temperatures or extreme humidity prevail, the thickness of the rings is, on the average, proportional to the rainfall, for the amount of growth each year depends upon the available supply of food, which in turn is determined by the amount of moisture. This is true more or less in all regions, but especially in places like Arizona where the temperature of summer is high enough to promote rapid growth, while the water-supply is limited, and the life struggle of the tree is against drought and not against cold nor undue moisture nor against its fellows or members of other species. The measurements made by Douglass show that the theoretical expectation is realized, for the curves of growth and of rainfall for the forty years or so since records are available present a marked agreement. Manifestly, then, the curves of growth may be used as a means of determining the rainfall in periods long antecedent to any human records. Douglass has so used them, and his analysis indicates cycles of precipitation with a periodicity of 11, 21·2, and 32·8 years, a result which agrees with the cycles indicated by records of rainfall. He did not attempt to investigate larger cycles, nor to determine the relation of the climate of periods separated by hundreds of years. Obviously this is possible, and it needs only an expansion of Douglass' method, and a study of the sources of possible error to enable us to come to definite conclusions as to the nature of the climate at any time back to the youth of the oldest available trees.

During the year 1911 I began to make use of the method of Prof. Douglass and obtained some most interesting results. In the first place, Prof. H. S. Graves, Forester of the United States Forest Service, most courteously placed at my disposal several thousand stem analyses obtained from old trees by the members of his Bureau in various parts of the United

States. In the second place, I went to California on behalf of the Carnegie Institution, and with the help of two assistants made similar analyses of about two hundred of the "Big Trees" or *Sequoia gigantea* of the Sierra Nevadas. The term "stem analysis," as used by foresters, means the measurement of the thickness of the rings of annual growth beginning at the outside and working inward. When the year in which the tree is cut is known, it is, of course, an easy matter to determine the rate of increase in the diameter of the trunk for any year desired during the life of the tree. Stem analyses are made by the Forest Service at various points along the length of felled logs while they are in process of being sawed for the market. Only those at the base, however, that is "stump analyses," have been used in the present calculations, as they appear to give the most accurate results, and as they are the only kind possible in the case of the Big Trees of California. The measurements of the Forest Service and my own were made on the basis of ten-year rather than annual periods. That is, the thickness of the rings was measured in groups of ten instead of for individual years. Thus we can estimate the rainfall for the decade 1801–1810, but not for the specific years 1803, 1809, and so forth. In the present paper I shall take only two samples from among the considerable number of species of trees whose analyses Prof. Graves placed at my disposal. The others will be presented later in the final report already mentioned. Also, I shall not attempt to discuss in detail the methods of correction which have been employed in order to eliminate the effect of the decrease in the rate of growth which is the normal effect of increasing age. I shall leave that, together with certain other more mathematical considerations for an article in the *American Journal of Science* and for the report on "The Climatic Factor."

Let us first ascertain what may be learned from a study of the trees of New Mexico which grow in the mountains close to the ruins which we have hitherto been considering. The courtesies of the Forest Service have included not only the placing of a large number of stump analyses in my hands by the chief of the Bureau, but also some most helpful compilations by other members of the Service. I am especially indebted to Mr. A. B. Recknagel, Chief of Silviculture at Albuquerque, New Mexico, who has gathered a most valuable series of statistics for the yellow pines of that state, and has most generously allowed me to use them. His data are based on 645 trees from four of the United States Forest Reserves, as follows:—

	Gila forest.	Jemez forest.	Datil forest.	Zuni forest.
Over 200 years of age ...	53 trees	10 trees	74 trees	164 trees
Under " " ...	124 "	19 "	66 "	135 "

Total number of trees over 200 years of age	301
" " " under " "	344
Grand total	645

The Gila and Datil National forests are in the south-western part of

New Mexico near the Arizona line. They lie between the ruins of the Santa Cruz valley and those of the Jarilla mountains, and about equally distant from both. The Jemez forest lies in the centre of the northern part of New Mexico, and adjoins the Pajaritan plateau where the ruins of Tuyoni and the Canyon de los Frijoles are situated. The other reserve, the Zuni forest, is situated in north-western New Mexico somewhat more than 50 miles south of the remarkable ruins of the Chaco canyon. Thus the forests are scattered in such a way that they have approximately the same distribution as the ruins with which we have been dealing. In general, however, they lie at greater altitudes than the ruins. "The measurements," to quote Mr. Recknagel, "were all taken within the Western Yellow Pine type between altitudes of 7000 and 9000 feet. They were taken in the main body of the Western Yellow Pine type, and, therefore, can be considered as belonging to members of the pure stand of the species." In other words, the trees with which we are concerned grew in the portion of the yellow pine area where the trees grow best and where they are neither at the lower limit so as to be especially liable to injury by drought nor at the upper limit so as to be especially liable to injury by excessively low temperature or long winters. Moreover, they were not selected with a view to any special characteristic other than age. All the available analyses of trees over 200 years of age were used, and to them were added an approximately equal number of younger trees in order to afford fair comparisons.

From Mr. Recknagel's figures I have computed how fast the average tree grows during the first, second, and third decade, and so on to the end. This shows that the average tree grows 0·46 inch during the first decade of its life, 0·63 during the third, 0·40 in the twelfth, and only 0·23 in the thirtieth. Obviously if we are to compare the climate of different periods during the life of the tree, we must eliminate the differences due merely to the fact that the tree has grown older. For instance, a growth of 0·46 in the first decade indicates no more propitious conditions of climate than a growth of 0·23 during the thirtieth decade when the tree is 300 years old. All that we need to do is to multiply the rate of growth of the old trees by the proper factor, two in this case, and the result will show the relative effects of climate. For example, suppose that in the decade 1610–1620 a tree grew 0·40 inch, and in the decade 1901–1910 it grew 0·19 inch. Multiplying the growth during the last period by two, which is the corrective factor for the thirtieth decade, we get 0·38 inch as the rate which the tree would have grown had it been in its first instead of its thirtieth decade. The difference between 0·40 and 0·38 is due to some external cause. The external cause may be an accident, but when a large number of trees are averaged together, the influence of accidents disappears and the remaining differences are attributable to climate. One more correction, however, must needs be applied. A study of Mr. Recknagel's figures, as well as of many others, shows

clearly that if a tree is to live to old age, it cannot grow fast in its youth. That is, if we take a large number of trees so as to obtain averages, the tree which grows faster than the normal rate in its youth dies at less than the average age, while one which grows abnormally slowly stands a good chance of living to an exceptional age, provided the slow growth is not due to disease. Hence, before we can compare the rates of growth of different trees, we must apply another correction which I have called the correction for longevity. This applies to the old trees during their youth, but not in their old age. Hence our figures 0·40 must be multiplied by another factor giving 0·41 as the final result for comparison with 0·38. These two

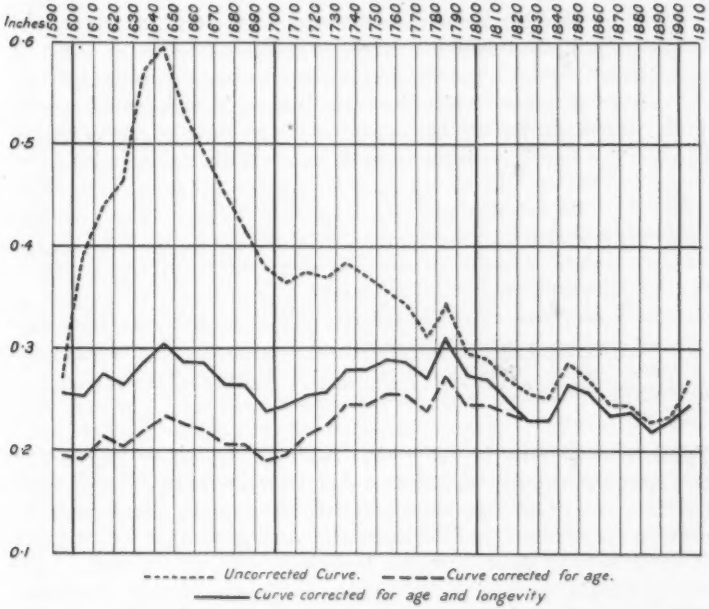

FIG. 1.—CURVE OF GROWTH OF 50 YELLOW PINES OVER 280 YEARS OF AGE.

types of correction sound somewhat complicated, and so they are. The point to be noted, however, is that they are purely mathematical, and that they do not depend upon the individual judgment of the investigator. While he is working out the calculations he cannot have any idea of the exact results which will be obtained; nor can he make the results fit one theory rather than another except by wilful manipulation.

The accompanying diagrams, Figs. 1 and 2, show the results of Mr. Recknagel's tree analyses when computed according to the method here described. In both figures the horizontal line indicates the course of time from 1590 to 1910 A.D. The height of the curves indicates the relative

rate of growth of the trees at any particular date. Fig. 1 is given simply as an example to show the effect of the corrections. It is based upon the fifty oldest trees, which began growth at periods ranging from 1460 to 1590 A.D. The upper dotted line indicates the actual average rate of growth of these fifty trees without any correction whatever. The lower dash line is the same curve after the correction for age has been applied, that is, after allowance has been made for the fact that young trees grow faster than old. The solid line shows what happens to the curve when the correction for longevity is added to that for age; that is when allowance is also made for the fact that during their youth trees which are to live to a great age regularly grow more slowly than the normal rate.

In Fig. 2 the solid line represents the curve of growth and presumably of climate as derived from the 272 of Recknagel's trees which began to grow before 1700 A.D. The numbers in parenthesis at the bottom indicate the number of trees on which the curve is based in each decade. From 1700 A.D. onward, the number remains uniform, since no new trees are added. The dotted line is the curve of growth of the red fir in the Lake

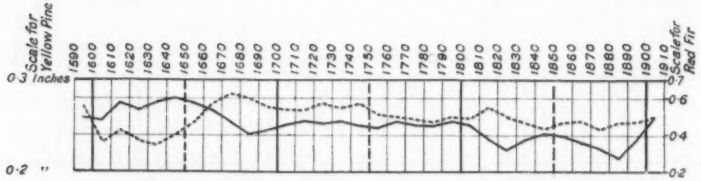

FIG. 2.—CURVES OF GROWTH OF YELLOW PINE (SOLID LINE) AND RED FIR (DOTTED LINE).

Tahoe National forest in California. At first sight this curve seems to be almost diametrically opposed to that of the yellow pines of New Mexico, but there is no real discrepancy. In fact, the seeming disagreement is, perhaps, the strongest possible confirmation. The red fir of Tahoe grows at an altitude of about 8000 feet in latitude 39° near the crest of the Sierra Nevada mountains, 250 miles north-east of San Francisco. Although the altitude is the same as that of the yellow pines of New Mexico, and the latitude only 4° or 5° farther north, climatic conditions are quite different. The precipitation is much greater than in New Mexico, and comes largely in the form of snow. Moreover, it continues through the spring, which season is dry in New Mexico. The result is that in the mountains above Lake Tahoe the snow in ordinary years remains upon the ground well into June or even July, and the ground is saturated with moisture practically all the time. Too much moisture, and especially too long a continuance of the snow, are the factors which retard the growth of the red fir, whereas too little moisture and short, open winters are detrimental to the yellow pine. Hence we should expect that climatic conditions which would favour the pine, that is long, snowy winters, followed by

abundant precipitation in the spring, would check the growth of the fir. In general, that is what we find; the two curves are almost the reverse of one another, a condition which does much to substantiate the idea that the climate of the past may be read from the trees.

Turning now to the interpretation of the New Mexican curve, we find a surprisingly close agreement with our conclusions based on the evidence of terraces, archæology, and history. Before going on to discuss the matter I would emphasize the fact that these conclusions were all reached before the trees had been investigated. They have been set down above exactly as they were reached, at a period of from fifteen to five months before any examination of the trees was made. The importance of this lies in the fact that the agreement of the mathematically derived tree curves with the conclusions derived from entirely different methods furnishes the strongest possible confirmation of the accuracy of those methods as employed both in America, Asia, and southern Europe. From the ruins of Gran Quivira, it will be remembered, we concluded that at the time of the Spanish occupation of New Mexico in the first half of the seventeenth century climatic conditions were distinctly more favourable than at present. About 1680 the ruins of Gran Quivira seem to have been finally abandoned at the time of the Pueblo rebellion. During the succeeding century conditions appear to have been somewhat better than during the one that ended in 1900, as appears probable from the ruins of Buzani, and one or two other places not here mentioned. The curve of the trees points to exactly the same conclusion. One reason why the Spaniards were able to establish themselves in New Mexico almost without a blow may have been that from 1600 to 1645 the amount of rain and the general conditions controlling the growth of vegetation were more and more favourable. Places like Gran Quivira were readily habitable and were growingly prosperous so far as their prosperity depended upon good crops. Under such circumstances the ignorant Pueblos would naturally look upon the coming of the Spaniards as a blessing. A decrease in rainfall begins to be apparent about 1645, but it is unimportant at first because the amount of growth of the trees, and impliedly of the crops, continues to be well above the normal until about 1665. Thereafter a rapid deterioration takes place, which culminates about 1680 or soon after. At exactly that time a widespread uprising took place against the Spaniards, the Pueblo rebellion, which ousted the Europeans for some years. Famine must have prevailed as the climate became drier, and the distress occasioned would almost surely lead the Indians to ascribe their misfortunes to their conquerors. Curiously enough a document has just come to light which confirms our conclusion as to famine. I am indebted to Mr. E. E. Free, of the Bureau of Soils of the U.S. Department of Agriculture, for calling my attention to an account of an old census given by Mr. J. W. Curd, in the El Paso *Times*. El Paso, although in Texas, lies almost at the middle of the southern boundary of New Mexico. The census is dated September 11, 1684, and contains a list

of 109 Spanish families living near El Paso. It is signed by the Spanish governor. "While the document is nothing more than a dry and uninteresting census roll," to quote Mr. Curd, "it is illuminative of the terrible devastation and suffering that resulted from the Indian revolt in 1680. This revolt destroyed some forty-two presidios and missions in New Mexico north of El Paso, and the remnant of Spaniards and friendly Indians took refuge in Guadalupe del Passo (El Paso). While the Mission Guadalupe was a rich one, and additional supplies were forwarded from Mexico City, the people still suffered from lack of clothing and food. The census shows that what crops were planted that year consisted only of maize, which, owing to drought, was an almost total failure. What maize was grown was eaten green, so there was no supply for winter." It is not here possible to carry the matter further. The curve speaks for itself. After 1680, conditions appear to have improved; the eighteenth century was a period of less rainfall than during the time of the early Spanish occupation, but of more than the last century.

The *Sequoia gigantea* of California is the largest and probably the oldest known tree. During the summer of 1911 I was able to make measurements of two hundred stumps which ranged from 6 to 25 feet in diameter, and from 250 to 3150 years in age. Three were over 3000 years old, and forty began to grow 2000 or more years ago. During 1912 a larger number were measured, but it has not been possible to complete the long tabulation and calculation which they require in time to use them in this article. The sequoia grows in a region which is climatically similar to New Mexico, except that it is colder and has no rainy season in summer. Long, snowy winters and rains continuing well into the dry summer are the conditions which favour growth. The curve of the sequoia has been computed in the same way as that of the other trees. The period covered by the growth of the trees, however, is so great that the number of trees whose analyses are now available is not enough to give certainty to the corrections. Accordingly, after obtaining a curve corrected as accurately as possible both for age and longevity, I averaged that curve with the original uncorrected curve in order to avoid the risk of over-correction. This means that the curve here given, the solid line of Fig. 3, is still subject to considerable correction. Nevertheless, I think it worth while to publish it at this time with the warning that it must not be accepted as final. The final curve, which will appear in the report to be published by the Carnegie Institution, will resemble the present one in its sinuosity, but the indications are that some of the maxima and minima will be pushed a few decades earlier, and that the portion from 1200 A.D. onward will not rise so high as in the present case.

Before we proceed to discuss the curve a word or two of explanation may be added. The solid horizontal line marked 10 is added merely for reference, to aid the eye in estimating the fluctuations of the curve. The figures arranged vertically on the margin indicate the growth in millimeters

per decade. The small underlined numbers in the body of the diagram near the bottom at intervals of two hundred and fifty years indicate the number of trees on which the curve is based. The dates in parentheses at the bottom are placed there to show that there is a possibility of error which will be corrected by further investigation. The extreme fluctuations of the early part of the curve give an exaggerated idea of the variability of the climate at that time. This is due to the small number of trees available. When more have been measured the extremely sharp character of the depressions and hollows, or of the arses and theses, as I have elsewhere called them, will disappear.

Examination of the curve shows that the climate of the interior of California has been subject to marked pulsations during the past three thousand years. For instance, at the time of Christ the tree grew 40 per cent. faster than at the end of the fifteenth century. Practically all the trees at the latter date were of large size with thoroughly developed root systems, and with a vast supply of strength stored up from the past. Moreover, they were growing high among the mountains where the supply of rain and snow was largest, and many of them were standing in swamps or beside brooks. If they could be so affected by drought as to show a decrease of 40 per cent. in the amount of growth, other less favoured plants must have suffered much worse. It is noticeable that in general the trees recover rapidly after a period of aridity and then fall off more slowly as another dry time approaches. This is important as an indication that climatic changes from dry to moist take place rapidly, while those in the reverse direction are slow. It bears also on another point. It may be suggested that the inequalities in the curve are due to accidents such as fires. In the first place, this is not probable since the two hundred trees were located in four different areas with a distance of 60 miles between the extremes, and with high mountains and deep valleys intervening. The rapid rise and gradual fall of the curves, however, disproves any such supposition. An accident, such as a fire or anything else, would suddenly cause the trees to grow slowly, after which they would gradually recover, whereas the actual case is the reverse of this.

In Fig. 3 I have added a dotted line. This is the curve of climatic pulsations in Asia as given in 'Palestine and its Transformation.' The two curves disagree in certain places, but on the whole they are in surprising harmony. The disagreements may be due to the absence of data in compiling the Asiatic curve; for instance, between 1200 and 1000 B.C. I had no data whatever, and hence merely drew a straight line. In other cases the fact that indications of aridity happened to be especially well preserved at a certain time, such as the seventh century of our era, may have caused me to carry the Asiatic curve lower than was justifiable. It should be noted, however, that in the fully corrected sequoia curve the lowest point of all will apparently fall earlier than 720 A.D., which will agree with the Asiatic curve more closely than is here apparent. Moreover, the longest

continuous decline anywhere apparent in the California curve is from the time of Christ to the beginning of the eighth century. The greatest disagreement between the two curves is found about 300 A.D. Whether there actually was disagreement at that time, or whether I have made a mistake in the Asiatic curve, I shall not here attempt to discuss. In general it may be said that the three noticeable depressions in the Asiatic curve, namely 300, 650, and 1200 A.D., are possibly all exaggerated because special events due apparently to increasing aridity happened to culminate at those particular epochs.

In spite of certain disagreements, by far the most noticeable fact about the curves is their close agreement. Take the epoch centring at the time of Christ, for example, or those which centre 1000 or 1600 A.D. The agreement is so close that it cannot possibly be a matter of chance. Further

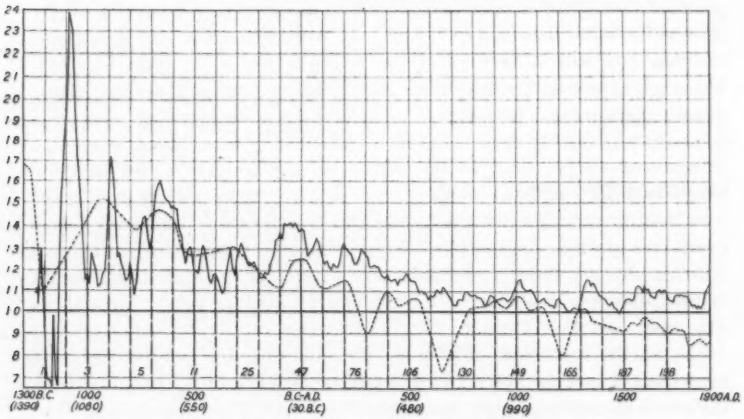

FIG. 3.—CURVE OF GROWTH OF THE *SEQUOIA GIGANTEA* OF CALIFORNIA (SOLID LINE), AND CHANGES OF CLIMATE IN ASIA (DOTTED LINE).

discussion of the subject must be deferred for the present. We can here merely sum up the main conclusions. The study of the trees of New Mexico and California in the first place confirms the conclusions derived from examination of the ruins and physiographic evidences found in the drier parts of North America. It thus shows that the methods upon which those conclusions are based are sound, and that the results derived from such methods whether in America or Asia are valid. In the second place the trees confirm the theory of pulsatory climatic changes. They show that the climate of the Earth is subject to pulsations having a period of hundreds of years. In the third place the rate of growth of the trees indicates that in the distant historic past the moist epochs were on the whole moister than the similar epochs in more recent times. Fourth and last we are led to conclude that the main climatic changes of America are synchronous with those of Asia and are of the same kind. This does not

mean that changes in tropical countries are like those in the temperate zone. It does indicate, however, that in the temperate continental regions of the world periods of exceptional aridity or of exceptional moisture have occurred at the same time, and have sometimes lasted for centuries. Hitherto this point has been open to question, and therefore historians and other students of man have been sceptical as to the possibility that climatic changes could have been of sufficient importance profoundly to influence history. With the fuller application of the methods here discussed, we shall soon be able to determine the exact nature and degree of climatic changes throughout historic time, and then we shall have the basis for a true appreciation of their effect upon history.

MODERN OCEANOGRAPHY.

By HUGH ROBERT MILL, D.Sc.

THERE are so few systematic works on Oceanography in the English language that the appearance of two practically simultaneously is a notable event, and although they differ in scope and treatment they may be discussed together very appropriately, for they are at one in explaining the application of the newest methods to the old problems of the sea, and both have as their aim the advancement of oceanography by renewed research.

The epoch-making character of the *Challenger* expedition has thrown perhaps unduly into the shade the earlier work upon the results of which the *Challenger* methods were founded; but to understand the history of oceanography we must refer to two works which in their time were repositories of the latest known facts, formed starting points for new discoveries, and are still full of inspiration for the student. The first of these is Maury's 'Physical Geography of the Sea,' first published in 1855, and it may be viewed as the originator of modern oceanography and maritime meteorology. It is one of the few books on natural science, the spirit of which makes it immortal even when the facts it handled are out of date and the theories it formulated cast aside. The second is Sir Wyville Thomson's 'Depths of the Sea,' a description of the cruises of the *Lightning* and *Porcupine* in the North Atlantic in 1868 and 1869, which gives an accurate account of the methods and equipment of oceanographical expeditions just before the voyage of the *Challenger*.

After the *Challenger* expedition, 1872–76, there was a lull in investigation at sea, while the immense results were being worked up. Before the completion of the *Challenger* publications, the art of deep-sea sounding had been revolutionized by the work of the telegraph ships. The result of this improvement and of the international co-operation in the *Challenger* memoirs was that the science which had been almost exclusively British was taken up by investigators in many different countries, and important

national expeditions were sent out in the Atlantic by the French, Norwegian, and German governments; in the Indian ocean by the German and Dutch; in the Mediterranean by the Austrian and Italian; in the Pacific by the Russian and United States; in the Baltic by the Swedish and Danish; in the Atlantic by the Prince of Monaco; and in the Polar Regions much oceanographical work was done by the expeditions of the *Fram*, the *Belgica*, the *Scotia*, the *Gauss*, and the *Discovery*. Most of these expeditions contributed something to the improvement of methods and apparatus. During the last ten years the establishment of the International Council for the Study of the Sea has united British, German, Belgian, Dutch, Danish, Swedish, Norwegian, Russian, and Finnish Government delegates, versed in all departments of oceanography, in a systematic investigation of the North Sea and adjacent waters with a view to the improvement of fisheries; and the foundation of the *Challenger* Society has brought together all British students of oceanography in one of the least formal and most practical of the smaller scientific organizations in London. One of the books before us is due to the collaboration of a number of members of the *Challenger* Society, the other is a direct result of the work of the International Council.

'Science of the Sea' is the work of members of the *Challenger* Society under the skilled editorship of Dr. G. Herbert Fowler.* It is designed for the use of the sea-farer of scientific tastes, and endeavours to answer his imaginary question: "How can I do some work for science? I don't know anything about it; where can I read it up?" In his preface Dr. Fowler says:

"However valuable the information in this handbook may prove to be, it must remain elementary. It is no "royal road;" in no sense will it do away with the serious study which all those must undergo who, not content merely to record observations, wish also to grasp the usefulness and meaning of what they are doing. But the book may fairly claim to have brought between two covers instructions, of which many are not in print, and the rest are scattered and hard to find."

As a participator, though but to a small extent, in the authorship of the book, the writer of this notice can hardly express an opinion on the success with which the editor's intentions have been carried out. He collaborated with Captain Wilson-Barker in writing the first chapter, "The Air." Dr. H. N. Dickson and Mr. D. J. Matthews wrote on "The Water;" Prof. Stanley Gardiner on "Tropical Shore Collecting;" Prof. Blackman and others on "The Plants;" Dr. Fowler with other experts on "The Floating Animals," "Yacht Equipment," etc.; Sir John Murray on "The Sea Floor;" Dr. Calman and Mr. Farrar on "Animals of the Sea Floor;" Dr. E. J. Allen and others on "Dredging and Trawling," and "Preservation of Marine Organisms;" Mr. L. W. Byrne on "Fishes and Fishing;" and

* 'Science of the Sea: an elementary handbook of practical oceanography for travellers, sailors, and yachtsmen.' Edited by Dr. G. Herbert Fowler. London: J. Murray. 1912. 6*s. net.*

Prof. D'Arcy W. Thompson on "Whales, Seals, and Sea-Serpents." The editor has added most useful appendices, including classification tables of animals and plants, a bibliography, and a list of Marine Stations where scientific work is carried on, from which it is interesting to notice that there are ten of these in the United Kingdom, eighteen in France, fourteen in the United States, only three in Germany, which suffers from lack of seaboard, and in all other countries twenty-three, making a total of sixty-eight. With such a book available, no one, however ignorant he may be at the outset, can fail to grasp the methods and the elements of marine research should he wish to do so.

The second book, 'The Depths of the Ocean,' * is like the first in its composite authorship, for in addition to the chapters written by Sir John Murray and Dr. Hjort, there are important contributions by Dr. Helland-Hansen, Professor Gran, and Professor Appellöf; but it is two and a half times as large, and it forms both a narrative of the results of one cruise and a general account of the place which these results occupy in modern oceanography, being thus to a great extent a resumé of our existing knowledge of the oceans and a fairly comprehensive account of the North Atlantic. The narrative of the cruise of the *Michael Sars* in 1910 and the preliminary results of the physical and biological observations made during it which form the thread on which the 'Depths of the Ocean' has crystallized, are familiar to the readers of this *Journal* through the excellent account given by Dr. Hjort to the Royal Geographical Society and published in vol. 37 (1911), pp. 349–377, 500–523. The story as now published of a really adventurous voyage in a small and overcrowded vessel has not been "written up" in any way. Few incidents are referred to, and such discomforts and dangers as are mentioned are passed over so much as matters of course that they are not allowed to detract from the scientific interests with which the book is really concerned.

To the general reader the most attractive chapters will undoubtedly prove to be those descriptive of the life in the great ocean, from the microscopic plants and animals to the larger invertebrates and above all the fishes. Few books have ever been provided with a greater wealth of illustrations, many of them fascinating coloured plates; but even the half-tone blocks in the text give a life-like presentiment of the quaint and unfamiliar forms they portray. Although no part of oceanography can be held foreign in a geographical journal, it may perhaps be most appropriate here to pass by the biology referred specially to the chapter on the "Depths and Deposits of the Ocean" by Sir John Murray, and to that on "Physical Oceanography" by Dr. Helland-Hensen. Sir John Murray and Dr. J. G. Bartholomew have kept up to date the bathymetrical charts prepared in 1886 for the *Challenger* 'Reports,' adding all new soundings in deep water as they have been

* 'The Depths of the Ocean: a general account of the modern science of oceanography, based largely on the scientific researches of the Norwegian steamer *Michael Sars* in the North Atlantic.' By Sir J. Murray and Dr. Johan Hjort. London: Macmillan. 1912. 28*s. net.*

recorded and redrawing the contour-lines to correspond. A chart of the North Atlantic on the scale of 10° of latitude to 1 inch, and a reduced Mercator chart of all the oceans on the scale of about 25 equatorial degrees to 1 inch are given, and these afford a good general view of the areas at various depths as defined by the contour-lines of 100, 500, 1000, 1500, 2000, 3000, and 4000 fathoms. Sir John Murray does not adopt the principles of nomenclature and terminology laid down by the Committee of the International Geographical Congress, and it must be acknowledged that his system has at least the merit of simplicity. He terms all areas beyond the 3000 fathoms line of depth "Deeps," and these are the only features to which he gives names. The international rule is to name all submarine features by reference to their geographical position and to restrict personal names or the names of ships to notable points, such as the greatest depth in a depression or the least on an elevation; but Sir John Murray's names for Deeps are those of men and ships, and flattered as I am to find his kindness extend so far as to name a little North Atlantic deep after me, I am none the less of opinion that the International rule is a sound and salutary one. It is probably impossible to impose either terminology or nomenclature by authority, and no doubt a working system will shape itself in time by fit survivals from diverse attempts.

Sir John Murray is of opinion that future deep-sea soundings in the North Atlantic will not result in any material changes in the contour-lines of depth, although more submarine cones like the Seine bank and Dacia bank may be discovered. In dealing with the deposits he is in a very special sense in his own domain, for no one else has a hundredth part of his experience in dealing with, identifying and charting the material of the ocean floor. It is pointed out that in the North Atlantic one half of the bottom is covered with Blue Mud and other deposits directly derived from the land, and hence termed *terrigenous*, the proportion of these being greater than in any other ocean. The other half is occupied by *Pelagic* or true deep oceanic deposits, and of these the most abundant and typical in the Atlantic is Globigerina Ooze, the modern analogue of the Chalk containing a large percentage of calcium carbonate. It covers about 39 per cent. of the ocean floor. The deepest sounding of the *Michael Sars* in 2966 fathoms brought up Globigerina Ooze containing 64 per cent. of calcium carbonate, and in no other ocean is this deposit found at such great depths.

Red Clay, the most widespread of all deep-sea deposits in the Pacific, covers only 11 per cent. of the floor of the North Atlantic, and Pteropod Ooze occupies about 1 per cent. The contributions of the *Michael Sars* to the knowledge of deposits were interesting, but they do not change the established theory of the origin and distribution of the various muds and oozes. Some very fine examples were obtained from the sounding tubes, one from 2966 fathoms was 14 inches in depth, showing distinct stratification, the upper portion containing 64 per cent. of carbonate of lime and the lower portion only 25 per cent.

Dr. Helland-Hansen's chapter on "Physical Oceanography" is a splendid contribution to the science. It extends to 97 pages, and is an admirable exposition of the most recent instruments and methods as perfected by the Norwegian investigators. He also gives a summary of results as to the physical condition of the water in the North Atlantic, and dwells on the important relationship between the temperature of the surface water of the ocean and the climate of the countries bordering upon it; but he points out that much further research is necessary before oceanographers will be able to solve all the problems which the expeditions of the past and of the present have brought forward.

It is most heartily to be hoped that the sphere of the International Council will be widened to the whole Atlantic by the co-operation in the work of the United States and Canada on the other side of the Atlantic and of France on this, while the increased public interest in drifting ice caused by the *Titanic* disaster has turned the attention of the Board of Trade to the need for additional research in the region lying to the north of the steamer tracks. It is not often that the need for investigation in any department becomes acute just as the means for carrying out such investigations have been brought to a state approaching perfection, and we sincerely trust that advantage will be taken of the moment and the means to extend our knowledge of Atlantic oceanography in the confident expectation of immediate practical applications.

A VISIT TO LABRANG MONASTERY, SOUTH-WEST KAN-SU, NORTH-WEST CHINA.

By Major GEORGE PEREIRA, C.M.G., D.S.O.

I LEFT Lan-chou Fu on May 2, 1912, taking two Pekingnese boys, and horses, whilst my baggage followed on mules. It is three stages to Ho Chou across a hilly country, occupied by Chinese and Mohamedans, with three steep hills to cross. The hills are mostly terraced for cultivation. Ho Chou, 70¼ miles distant with a population of under 30,000 inhabitants, consists of a northern or Chinese city and a southern or Mohamedan city, and is the centre of the Mohamedans of the province of Kan-su. It lies in the fertile valley of the Ta-hsia river, called Ta Ho or Great river by the people. This valley is followed all the way up to Labrang, 78¼ miles distant. After the first 23 miles, the hills get higher and close in, and villages and cultivation become less; the only crop grown in the upper part of the valley is Ch'ing-k'ou, the huskless barley. Three or four of the bigger villages are occupied by Mohamedans or Chinese, but the population consists mostly of domesticated Tibetans (known as "Chia-fan" in the Hsi-ning district), who have a good deal of Chinese blood. It is a very noticeable fact that the Chinese who take Tibetan wives in these regions soon adopt Tibetan manners and customs, and their descendants are

more Tibetan than Chinese. This is not the case, however, with Mohamedans, who do not so often make Tibetan marriages. Domesticated Tibetans, living in villages, are found all along the borderland and separate the Chinese from the nomad Tibetans who live in black tents, and have large herds of sheep, ponies, yaks, etc., guarded by large dogs, the fiercer of which are kept chained when the nomads visit the Chinese borderland. Beyond Ch'iao-kou, the country is under Tibetan rule, though nominally dependent on the Chinese sub-prefect of Hsün-hua T'ing, further north. Though officially part of the province of Kan-su, it is really Tibet.

At Sang-so-ma, 55 miles from Ho Chou, there is a Tibetan monastery and a village with nine Mohamedan families and one Chinese. There is a good deal of Chinese or Mohamedan traffic between Ho Chou and Labrang, the latter, for instance, being dependent on Ho Chou for flour, and, in cases of trouble with the monastery, the Chinese can bring pressure to bear on them by closing down the flour supply. Rafts of logs, worked by two Chinese, are floated down the river from Labrang (when the water is high) to Ho Chou, and thence by the Yellow river to Lan-Chou.

Sang-ta-wa, a village of from three to four hundred Mohamedan and Chinese families, is the halting-place for Labrang Monastery, $\frac{3}{4}$ mile distant. At Labrang I took the precaution of sending in my card to the head Buddha, and finding one belonging to the provincial treasurer (fan-t'ai) of Kan-su, I sent it in with mine, the Chinese equivalent of a letter of introduction. I then received a message to say that two guides would be sent to show me round. These soon made their appearance, one a monk, the other a Yamen runner, both men of a villainous type of countenance. Escorted by these and a curious but inoffensive rabble of monks, Tibetans, Chinese, and Mohamedans, I then started on a walk round.

Of the great monasteries of Kan-su, Labrang is perhaps the most important. The head Buddha is elected by divination by the living Buddhas of the monastery, and the choice is sent to Lhasa for ratification by the Dalai-Lama, who may, however, alter the selection. Kumbun has more monks, but it is more directly under Chinese influence and has not therefore so much religious importance. The other important monasteries are Bya-kyung (pronounced Sha-Zung) and Rung-bo (pronounced Rung-o), 10 miles south of Pao-an or two stages north of Labrang, each with 1000 monks, Hei-t'so between La-brang and old T'ao-chou with from 800 to 1000 monks, and Cho-ni on the T'ao river (south-east of old T'ao-chou) with about 500 monks.

At Labrang there are altogether 3600 monks and boys. The head Buddha or Jong-yang-sheba (in Chinese Chia-mu-yang) was away at Lhasa. The present incarnation is about 65 or 66; under him there are 18 living Buddhas. Below them are 500 lamas or superior priests. Below them come "dge-long" or ordained priests, "dge-tsug" or acolytes, and "pandi" or neophytes.

For the management of affairs there is a treasurer (Hsiang-zot), directly under the head Buddha, assisted by two stewards. For discipline, there is a president (Jewa). He has powers of punishment. For grave offences a sheet of paper is put over the monk's face and he is branded on the forehead with a red-hot key and is then led to a small door and banished from the monastery. Another punishment is cutting off the ears or nose, but this is rarely, if ever, practised. Another punishment is to suspend a monk by the hands from a tree, either entirely or with his toes just

touching the ground, and he is kept suspended for different lengths of time up to two or three days. The commoner punishments are beatings, or else being fined. Even lamas are liable to be punished in these ways, though generally they are given the opportunity of getting away. Below the president there are five "dgo-dgos" (pronounced gay-gay) or "virtuous commanders," each in charge of a hall or section, devoted to a branch of Buddhist learning, such as doctrine, astrology, dancing, etc. During the services they walk about carrying sticks, with which they rouse nodding monks. All the monks at Labrang are Tibetans, and belong to the yellow

or reformed sect. All monks have their heads shaven, whilst the village Tibetans wear a small queue. Immorality appears to be very prevalent in the monasteries, and not rare even among the living buddhas.

Under the monastery there is a Tibetan Ya-man, or civil court, presided over by two officials of equal rank, called Onyerwa. They can inflict barbarous punishments, and it is a disgrace to Chinese officials that they allow Chinese and Mohamedans to be tried by this tribunal. Tibetan villages extend 6 or 7 miles west of the monastery. Beyond that there are only nomad Tibetans, known as Abrogba (pronounced Drok-wa) who live in tents. The Tibetans are a lawless race, possibly 90 per cent. are robbers; they are continually at war amongst themselves, and this enables the Chinese to exercise some sort of authority over them. Mohamedan and Chinese traders go amongst them only in large bands, and pacify the robber chiefs with presents. The Tibetans appear to spend their time between robbing and being robbed, whilst Chinese officials have their own ingenious methods of squeezing them, and Chinese merchants fleece them unmercifully when they visit the towns.

The monastery of Labrang lies in the valley of the Ta-hsia river, and a very good view of it is obtained from the hills to the south. It is much better situated than Kumbun, which is crowded up in a narrow circling valley. It consists of a large network of buildings, conspicuous among which are two gold-roofed buildings on the north side. Of these one is two or three storied with a bronze roof over which gold has been poured, and is the residence of the head Buddha. The other called the Kin-cov, is the chief temple and is single storied with a double roof on which gold has been poured over the bronze. The roofs of these buildings are of Chinese architecture. Standing up among the rest there are some thirty two-storied temples or houses, the residences of the living buddhas, mostly of stone painted red with layers of brown reeds laid crosswise above the stones and with ends cut off evenly, giving a quaint appearance to Tibetan buildings, unlike anything I have seen elsewhere. The windows are closed by shutters and formed by black beams, the side ones slanting inwards from bottom to top, giving them a sort of ancient Egyptian appearance. Golden plaques hang down on the front of the houses, whilst there are two gold stays over the doorway. One building in the south-east corner of the monastery has a fine green-tiled Chinese roof, but the rest have flat roofs ornamented along the fronts and at the corners by golden objects, which look like tea-urns, milk cans, and small pagodas. I only noticed two chortens, viz. a fine big gold one at the south-west corner, and a whitewashed one at the north-east end, around which a band of pilgrims circled like a stream of ants.

The monastery is completed by innumerable lower buildings, generally whitewashed, with courtyards, where the ordinary monks reside. These are separated by rows of narrow streets. There are in addition, as at Kumbun and elsewhere, special kitchens with huge circular Chinese bronze

ovens. These are used on feast days or when the monks are specially engaged by a private family to chant prayers, and the tea and rice for the whole of the section is prepared here, the cost for feast days being defrayed out of the monastic funds, whilst for private services it is paid for by the family in whose behalf the prayers are said.

On the east and south sides of Labrang are long, narrow porticoes filled with large prayer-wheels or rather revolving cylinders with Tibetan words in black, some painted bright red and other colours, or faded by constant use. The pilgrims as they pass down the porticoes, give the cylinders a push, and thereby store up a fund of countless prayers without any mental effort. Sometimes one sees a man, woman, or monk making a full-length prostration, bumping the head and describing a semicircle with the arms as far as they can reach. After which they rise and continue the practice. This appears to be the only form of Tibetan devotion requiring any special effort. At Kumbun, they assured me trained monks could do a thousand or more prostrations at a stretch. I did not visit any of the interiors of the temples, as they were all locked up, but, as is the case with all Chinese temples, there is nothing of interest inside. The porticoes were adorned with Chinese paintings, the most interesting of which are the Buddhist hells, where the Chinese artist revels in his element, and surprises the visitor by the novelty and ingenuity of tortures he invents, and by the expressions of placid enjoyment he depicts on the countenances of the presiding demons.

According to my aneroid, Labrang is 10,430 feet above sea-level, but this may be several hundred feet too high (?).

From Labrang I returned to Sang-so-ma, and taking one soldier as an interpreter I traversed a purely Tibetan country for three days to old T'ao-chou. At Hei-ts'o, the first stage (23½ miles), there is a monastery of some 800 Tibetan monks; near it there is a village with 75 Chinese and Mohamedan families. The village has two streets, the houses being flat-roofed, so that one can walk from one end to the other. As the inns were filthy with only one room for guests and stabling, I decided to occupy a small room on the roof. Here I was pestered by crowds of monks, Tibetans, Chinese and Mohamedans, who wished to see the foreign curiosity, and tore holes in the paper windows to get a good view. After repulsing them twice, I finally decided when I had finished my work to give them an uninterrupted view, and for two hours I sat outside or walked up and down till darkness brought me a relief.

Leaving Hei-ts'o I traversed a hilly country with a few Tibetan villages for the first 10 miles, and then for 15 miles among grassy downs occupied by nomad Tibetans (called Abrog-ba, but pronounced Drok-wa, meaning nomads) living in small black tents, guarded by fierce dogs, with herds of sheep, ponies and yaks. This part has a bad reputation for brigands, and my soldier had a scare, declaring some mounted robbers were waiting for us on a hill, but having got out and loaded my rifle, fowling-piece and

revolver, I failed to see them. That night I put up at a Tibetan inn at Wan-kur, where I shared the kitchen with my host and his family, and the next day I met with the kind hospitality of Mr. Simpson and his family, of the American Church and Missionary Society at old T'ao-chou, a small walled town of some 1500 families, chiefly Mohamedan. Fifteen and a quarter miles to the south-east is the town of Cho-ni with some 300 families, chiefly Tibetan or half breeds with Chinese, with a few Chinese. The Tibetans will not allow Mohamedans here. It is also the residence of the Tibetan prince of Cho-ni, Yang-ching-Ch'ina by name, a youth of twenty-three, who is, however, more Chinese than Tibetan in his manners and descent. He rules over forty-eight clans of Tibetans, and an area of country about one-third the size of Scotland. He receives tribute from his clans in various kinds, such as gold rope, grain, etc. Owing to his injustice he is not popular in his principality. At Cho-ni, I met with the greatest kindness and hospitality from Mr. Christie and his wife. Just above the town there is a large Tibetan monastery with five hundred monks, among whom there are five living Buddhas. I visited it with Mr. Christie and met with a most friendly reception. Curiously enough, in the Tibetan monasteries of these parts are signs of phallic worship. The monks nominally do not pay any attention to them, and the images are kept out of general sight, but they are more resorted to by the people even than the worship of Buddha, and at one of the temple doors I saw offerings of birds. From Cho-ni I started on a short hunting trip in the country to the south, where the Tibetan wild sheep are to be found on the mountains, besides serow, leopards, muskdeer, wapiti, roe, wild boar, bears, ear pheasants, etc., in the hills near Cho-ni.

PROGRESS IN THE SUDAN; THE INTERNATIONAL MAP.*

By Colonel Sir C. M. WATSON, K.C.M.G., C.B., M.A., R.E., President of the Section.

THE last occasion upon which the City of Dundee extended its hospitality to the members of the British Association was in 1867, forty-five years ago, and, at that meeting, the President of the Geographical Section was Sir Samuel Baker, who had then recently returned from his explorations on the upper Nile, for which he had been awarded the Patron's Medal of the Royal Geographical Society, and which were of the greatest importance as regards that then little-known river.

In the Address which he gave to Section E, Sir Samuel Baker naturally referred at considerable length to the geography of the Sudan, and to the question of the sources of the Nile, which had been discovered a few years previously by Captain Speke and Captain Grant, when they visited the great lake, named by them the Victoria Nyanza, out of which flows the main branch of the river, the fertilizer of Egypt, which, after a course of more than 3500 miles, pours its waters into the Mediterranean. He also spoke of the second great lake, the Albert Nyanza, which he had himself discovered, after a long and very

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arduous journey, though, perhaps naturally, he did not dwell so much on what he had himself accomplished, as another speaker might have done. The words he spoke are well worth calling to remembrance, and, on reading them over, one is struck by the fact that hardly anything was then known of the country through which he travelled, but that, thanks to him and his predecessors, Speke and Grant, the first steps were taken which led to half a century of steady progress in geographical knowledge, until now the basin of the upper Nile is fairly well known and fairly well mapped.

To-day I propose to take up the tale where Sir Samuel Baker had to stop, and to give a short *résumé* of the story of the Sudan since those days, more especially from the geographical point of view; it will be necessary briefly to allude to its history also, for, in this case, as in all others, history and geography are closely united, and it is difficult to understand one without knowing something of the other.

There is a considerable amount of uncertainty in the minds of some people as to what the Sudan is, an uncertainty not without reason, as the word has an ethnological rather than a geographical meaning. The complete word, Balad-es-Sudan, is an Arabic expression for the country of the black people, and therefore includes, theoretically, all those parts of Africa which are inhabited by Negro or Negroid races. There has, however, been such a mingling of different races that it would be difficult to say to what part of the great continent the word Sudan should properly be applied. But, of recent years, changing from its original ethnological meaning, it has come to be regarded as the name of a more limited area; and perhaps the simplest definition is that it includes all the country watered by the Nile and its tributaries, as far north as the twentieth degree of latitude, and excluding the Sahara, and the basins of Lake Chad and the Congo on the west, and the districts watered by the river systems which terminate in the Red sea and Indian ocean on the east. Such a definition does not, of course, altogether agree with the existing political divisions, as it includes the eastern part of Abyssinia, Uganda, and part of the Congo State territory; but these divisions are in no sense geographical, whereas the basin of the Nile is a well-defined region which contains the greater portion of what may be regarded as the real Sudan.

There is one point as regards the geography of the Sudan which is remarkable and perhaps unique. In former times it was to a certain extent known, and, in the maps of Ptolemy, and of the Middle Ages, the great lakes, the ranges of mountains, and the rivers flowing from them, are indicated in a distinct, if not very accurate manner. But, owing to various causes, this geographical knowledge was completely lost, and the natural features disappeared from the maps. Look, for example, at Keith Johnston's Atlas, published in 1843, and you will see that there are no lakes shown, while the Nile to the south of 10° N. lat. is indicated as an insignificant stream. The Sudan had relapsed into the position of a *terra incognita*, just as it had been in the days of Herodotus, and Ptolemy and the other ancient geographers were regarded as victims of their imaginations.

The revival of the knowledge of geography of the Sudan may be said to commence with the travels of James Bruce, who visited Abyssinia in 1770, explored Lake Tsana, and found what he believed to be the true source of the Nile in the river Abai, which ran into the lake from the south. He examined the place where the Blue Nile flowed out of Lake Tsana, but was not able to follow its course through the western mountains of Abyssinia, and rejoined it at Sennaar, about 220 miles above the junction with the White Nile. Travelling along the south bank of the Blue Nile, he crossed it at the ferry of El Efun, and

then went on to Halfaya, north of the site of the present town of Khartum, which at that time did not exist. Of the White Nile he says: "At half-past eight, about 4 miles further, we came to the village Wad Hogali. The river Abiad, which is larger than the Nile, joins it there. Still the Nile preserves the name of Bahr-el-Azrek, or the Blue river, which it got at Sennaar. The Abiad is a very deep river; it runs dead, and with little inclination; because, rising in latitudes where there are continual rains, it therefore suffers not the decrease the Nile does by the six months' dry weather." This is all he says of the White Nile, and he does not seem even to have taken the trouble to look at it, as he reports the point of junction of the two rivers as 4 miles north of Halfaya, whereas it is to the south of that place. He was so convinced that the Blue river was the one and only Nile that he regarded the investigation of the White Nile as unimportant, and shows it on his map as a comparatively insignificant river. Bruce's action in this matter is a warning to explorers not to neglect to examine something that does not fit in with their preconceived ideas.

At the time of Bruce's visit the origin of the White Nile seems to have been unknown to the inhabitants of the kingdom of Sennaar, a kingdom which had been established in 1504 by the Fung dynasty, which had taken possession of what had been the Christian kingdom of Alwah. Sobah, the capital of Alwah, was abandoned, and a new town built at Sennaar, which was made the seat of government. The Fungs were partly of Arab and partly of Negro descent, and their kingdom extended east of the Blue Nile to the foot of the Abyssinian mountains, and westward as far as the White Nile, beyond which were the independent kingdoms of Kordofan and Darfur. At that time there appears to have been little or no traffic on the White Nile, and the marshes of the tenth degree, inhabited by the powerful Shilluk tribes, formed an impenetrable barrier to the south.

But, although after Bruce's expedition to Lake Tsana the majority of people seem to have accepted the Blue river as the true Nile, there were some wider-minded people who felt that there was a secret hidden behind the marsh barrier. One of these was a certain Mr. W. G. Browne, who made an interesting journey to Darfur in 1793, and who records in the account of his travels that he had the conviction that the river, of which Bruce had discovered the source, was not the true Nile, and that he considered it a matter of great importance that the course of the more western river, *i.e.* the White Nile, should be investigated, as he could not believe that its source was only 200 leagues south of Sennaar.

Starting from Egypt, Browne travelled with a merchant's caravan from Assiut, by way of the oases of Khargeh and Selima, to El Fasher, in Darfur. Here he remained for three years, but was not able to do much in the way of exploration, as he was thwarted by the king and people, and was not allowed to go to Sennaar or to explore the White Nile. He collected, however, from the accounts given him by the natives, a good set of itineraries in Darfur and Kordofan, the first, so far as I know, compiled for the Sudan. But his efforts to obtain information as to the source of the White Nile were not successful, and all he was able to learn was that ten days' journey south of a place called Abu Telfan the Bahr-el-Abiad had its source in forty rivers, which came from the hills of Kumr. It seems probable that these numerous rivers were those that form the headwaters of the Bahr-el-Ghazal, and that the people of Darfur knew as little about the Bahr-el-Gebel, as the southern part of the White Nile is called, as the people of Sennaar.

But although Browne was not able himself to solve the mystery, his name should not be forgotten, as being one of the first in modern time to realize the fact that the White Nile was the longer of the two rivers. His views, however, seem to

have met with no support, and Bruce was supposed to have settled the question of the sources of the Nile. The great lakes, shown by Ptolemy and the mediæval geographers, were, as I have already mentioned, erased from the map, and the White Nile was left in peace.

During the visit of Browne to Darfur the kingdom of Sennaar had fallen upon evil times, as an insurrection, which had commenced during the reign of King Bady, ended with the death of King Adlan in 1789, when the Fung dynasty came to an end, and all authority fell into the hands of the tribal chiefs, who made and removed the kings of Sennaar at their pleasure. The internecine wars continued up to the time of the arrival of the Egyptians in the Sudan, and greatly facilitated the advance of the latter.

This advance of the Egyptians was due to the policy of Mahomed Ali Pasha, the Turkish Governor of Egypt, who had greatly increased his power by a successful campaign in Arabia in 1812–18, when he succeeded in capturing Mecca and Medina, and made himself master of the country. He then turned his attention to the Sudan, and decided to take advantage of the local troubles and to add Sennaar and Kordofan to the Egyptian dominions. In 1820 he sent an army up the Nile, under his son Ismail, who took possession of Dongola and the country adjacent to the river, as far as the junction of the Blue and White Niles, and, after seizing Sennaar, marched up the Blue Nile to Fazokl, on the Abyssinian frontier. Kordofan was also occupied, and the capital of the new Egyptian province was placed at Khartum, the point where the two Niles met, which took the place of the old capital of Sennaar; but no attempt was made to take possession of the country along the White Nile to more than about 100 miles south of Khartum. So little was that river known beyond this, that, when Linant Pasha succeeded in sailing up the river as far as the island of Aba, he was supposed to have arrived at the furthest point reached by a European since the first century.

No further advance was made for a few years, but, in 1838, Mahomed Ali decided to try to open up the White Nile, and an expedition under Major Selim, of the Egyptian army, succeeded in making its way through the marsh district, and in reaching a point about 6° 30′ N. lat. on the Bahr-el-Gebel, while another expedition in 1842 got as far as Gondokoro. It was thus proved that the marshes were not impenetrable, and trading stations began to be opened up, both on the Bahr-el-Gebel and the Bahr-el-Ghazal. On the former river, however, the traders could not at first proceed further than Gondokoro, as the rapids, which commenced a few miles south of that place, made navigation by sailing vessels impracticable, so the merchants had to establish their depôts at Gondokoro and depend upon the natives bringing ivory from the south. To these natives the opening of the river proved a great evil, as the legitimate traders were soon followed by slave-hunters, who carried thousands into captivity, while killing many others. By the ill-will thus created the difficulty of exploration was increased. In the end, the source of the White Nile was discovered, not from the north, but from the south, when Captain Speke, who, in company with Captain Burton, was exploring Central Africa from the east coast, heard of a great lake lying to the north, and succeeded in reaching the south end of the Victoria Nyanza in 1858. Convinced that he had found the long-desired source of the Nile, he started on another expedition, accompanied by Captain Grant, in 1860, and, after marching round the Victoria lake, reached Gondokoro in 1863. Here he met Sir Samuel Baker, who had started from Khartum in 1862, in the hope of discovering the Nile sources. The information given by Speke and Grant showed that they had forestalled him; but he continued his journey, and in 1864 succeeded in reaching the Albert Nyanza, the second great lake from which the White Nile derives its water.

Thus, at length, after a lapse of many centuries, the truth of the statements made by Ptolemy and other ancient geographers was justified, and the lakes shown by them were restored to the map of Africa, while the White Nile was proved to be the real Nile, and the Blue Nile was relegated to the position of being the most important tributary.

During the period of the travels of Speke and Baker the slave trade had been rapidly increasing, and the traders had practically taken possession of the country, and made themselves independent of the Egyptian authorities in Khartum. These slave traders cared nothing for geography, and had matters remained as they were at that time, it is probable that a State hostile to Europeans would have been established, and all chance of further exploration would have been lost.

But in 1869 the Khedive Ismail, who had succeeded as ruler of Egypt in 1863, and had obtained largely increased powers from the Sultan, decided to restore his authority on the White Nile, and appointed Sir Samuel Baker as Governor of the country south of Gondokoro, with instructions to establish Egyptian rule, as far as he could, to the south of that point. But nature fought against him, and the difficulty of sailing up the White Nile had been enormously increased by the formation of the sudd, that strange vegetable barrier which at times completely closes the river channel, and he did not reach Gondokoro until two years had elapsed from the time of his departure from Khartum. There he hoisted the Egyptian flag, and then proceeded to occupy the country to the south. But he was not successful, as the force at his disposal was quite insufficient, and, though he established a few stations on the road from Gondokoro to Foweira, on the upper Nile, little effective had been done when he returned to Gondokoro in April, 1873. Neither was he able to do much in the way of geographical research, and, greatly to his regret, was unable to revisit the lake which he had discovered on his first journey.

In 1874 Colonel Gordon was appointed to succeed Baker, and, leaving Khartum in March, reached Gondokoro in twenty-four days, the sudd, fortunately for him, having been cut through by the Egyptian officials only a month before his arrival in the Sudan. Gordon ruled the equatorial provinces until October, 1876, and during that time did much to tranquillize the country, as he had a remarkable influence over the natives. He moved the headquarters of the government from Gondokoro to Lado, and established a chain of posts along the Nile to Duflé, and thence to Nyamyongo, in Uganda, about 80 miles below the Ripon falls. He also placed two steamers and two sailing-boats on the Albert lake to facilitate communication. Gordon devoted much attention to the geography of the district, and prepared a map of the White Nile from Khartum to Urondogani, superior to any that had preceded it. This map included a plan of the Albert Nyanza, based on surveys made by Gessi and Mason, both of whom circumnavigated the lake. Mason reported the existence of the river, now called the Semliki, entering the lake from the south, but was unable to enter it, as the water was too shallow for his vessel.

Soon after his arrival at Gondokoro Gordon fully realized the difficulty of keeping up communication with Egypt by the Nile, and requested the Khedive to send an expedition to Formosa bay, about 100 miles north of Mombasa, on the east coast of Africa, with the view of opening up a road towards the Nile. The route he thought of was a little north of that now followed by the Uganda railway; but at the time he made the proposal the country was entirely unknown, and the difficulties would have been much greater than he anticipated. The idea, however, came to nothing, first, because the expedition was sent to the river Juba, on the border of Somaliland, which was much too far to the north; and, secondly, because it was ordered away by the British Government, which considered that it was encroaching on the territories of the Sultan of Zanzibar.

At the time that Gordon was establishing Egyptian authority in the equatorial provinces the Khedive's dominions were being extended by the conquest of Darfur, and the occupation of the province of Harrar, with its port at Zeila, in the Gulf of Aden. An excellent reconnaissance of Kordofan was carried out by Colonel Prout, of the United States Survey Department, in 1875, and a reconnaissance of Darfur was made by Colonel Purdy, another American in the Egyptian service, so that considerable additions were made at this period to the geographical knowledge of the Sudan.

But soon afterwards there was a serious setback to the Khedive Ismail's projects of conquest. Having acquired Massowah, Tajurra, and Zeila, on the Red sea, he sent an expedition into Abyssinia in 1875, which was cut to pieces at Gundet, on the road to Adua, and another larger force sent in the following year was utterly defeated by the Abyssinians and had to retreat, with great loss, to Massowah. Some surveys were made by the American officers on the staff of the Egyptian army, but these expeditions did but little for geography, and their fate was the precursor of the destruction of Egyptian power in the Sudan.

Colonel Gordon returned to Egypt in December, 1876, and early in the following year was appointed Governor-General of the whole Sudan, a post he held for nearly three years, years of incessant labour, during which, much to his regret, he was able to do little for geography; as, though he travelled many thousands of miles through his vast territories, his whole time was occupied with questions of administration. He was wonderfully successful in his dealings with the inhabitants, and had he been left alone for a few years, the history of the Sudan would have been different; but he was constantly urged to send money to Cairo, money which he could not obtain without following the example of his predecessors and oppressing the inhabitants. This he would not do, and resigned in August, 1879, when he was succeeded by an Egyptian Pasha, who revived the old bad customs of the country. His appointment led to the result that might have been anticipated, and, in 1881, the revolt led by Mahomed Achmed, the Mahdi, broke out, and the Egyptians were driven out of the Sudan. Then the country was completely closed to Europeans, and nothing further could be done in the way of geographical discovery until the defeat of the rebels at Omdurman in 1898. Now, fortunately, peace is restored, a peace which, it may be hoped, will be a lasting one.

To geographers, of course, the existing state of affairs is very satisfactory, as it will undoubtedly lead to an increase in our knowledge of the Sudan and its resources. That knowledge is still very limited, much more so than many people are aware, and there are vast regions which still stand in need of careful examination. Maps, especially small-scale maps, are misleading, and convey the impression that more is known than is really known. Take, for example, the case of the Blue Nile, one of the most important tributaries of the great river. Of this, the head waters, Lake Tsana, first carefully examined by James Bruce, are fairly well known, and a good reconnaissance of this lake was made by Mr. C. Dupuis, of the Egyptian Irrigation Department, in 1903, a copy of whose interesting report is attached to the valuable Report on the Basin of the Nile, made by Sir W. Garstin in 1904.

The course of the Blue Nile from Famaka on the Abyssinian frontier to Khartum is also fairly well known, although not yet accurately surveyed. But of the river between Lake Tsana and Famaka, and of its course through the mountains of Abyssinia, our knowledge is very elementary, and it is doubtful whether the line as marked upon maps is correct. Here is a chance for a resolute explorer to distinguish himself by making a really good reconnaissance of this part of the river, and following it carefully from Lake Tsana to Famaka. But it would probably be rather an arduous task, and there would be many difficulties, natural and human, to overcome.

The question of the Blue Nile is only one of the many geographical problems to be solved in the Sudan. The upper waters of other tributaries, such as the Atbara, the Rahad, the Dinder, and the Sobat, and the mountains from which they flow, are also little known, and will require years of exploration, while great areas of the level country of the Nile basin remain unvisited and unsurveyed. This can be well realized by any one reading Sir W. Garstin's excellent report already mentioned, in which he gives an admirable summary of the hydrography, and deals with the important question as to the manner in which the water of the different tributaries of the Nile can best be utilized for improving the agricultural capacity both of the Sudan and of Egypt. Among other projects with this object he proposes the cutting of an entirely new channel of more than 200 miles in length, so as to allow the waters of the Bahr-el-Gebel to leave the existing channel at Bor, 80 miles north of Gondokoro, and to rejoin the Nile near the mouth of the Sobat below the sudd district; but, as he justly points out, the country through which this new channel would pass is practically unknown, as the whole of the area lying between the Bahr-el-Gebel, the Bahr-ez-Zaraf, and the Sobat is a *terra incognita*.

Sir W. Garstin points out that there is a great loss of water from the Bahr-el-Gebel between Gondokoro and Bor, for which he cannot account, and this is another point requiring to be investigated. Reading his remarks upon this subject reminds me of the time when I was assisting in General Gordon's survey of the Nile, when on this part of the river, at a point about 50 miles north of Gondokoro, I noticed a considerable branch leaving the Bahr-el-Gebel, and going apparently in a north-easterly direction. The native pilot told me that it was reported by the inhabitants to join the Sobat. It was impossible to investigate the truth of this statement, which, at the time, seemed rather doubtful, but it is interesting to note that a high authority like Sir W. Garstin records that the Nile loses a considerable volume of water near this place.

Whether the proposal of Sir W. Garstin to make this great canal will ever be carried out is doubtful; for my own part, I am inclined to think that, having regard to the amount of work to be done in the Sudan, it would be better to leave the Bahr-el-Gebel alone for the present. The cost of a canal such as that suggested would be very large, and if funds were available it would be better to spend them on a railway from the Sobat southwards. Sooner or later the railway, which now runs some distance south of Khartum to the point where it crosses the White Nile into Kordofan, will be extended, and in process of time will reach the Sobat. Meanwhile it might be worth while to select a point on the Sobat suitable for a bridge, and to make that point the northern terminus of a line of railway, leading southwards to Gondokoro, and later, on to Uganda. Communication between Khartum and this terminus would, for the present, be kept up by the White Nile, which, with the exception of one or two places, is navigable for the whole year.

Looking at the question of the Sudan from the geographical point of view, there has been a wonderful increase of knowledge since the last meeting of the British Association in Dundee; but, on the other hand, there is a larger amount of work yet to be done before the whole of the vast area will have been satisfactorily surveyed, and it must be remembered that the Sudan Government has claims of greater importance at present than that of carrying out a complete trigonometrical survey. But exploration will no doubt be carried on year by year, and the blank spaces on the map will gradually be filled up. Meanwhile we must wish Godspeed to the British officers in the Sudan, who are carrying out a great work of civilization, and, at the same time, adding to the geographical knowledge of the world.

Leaving the Sudan, I would like to allude to a very important geographical undertaking which has made considerable progress during the past year. This is

the production of the International Map of the World on the scale of $\frac{1}{1000000}$, a project which has been under the consideration of the leading geographers of the important countries for more than twenty years, since it was first proposed at the International Geographical Congress held at Berne in 1891. The question was discussed at succeeding Geographical Congresses, but did not take definite shape until the meeting held at Geneva in 1908, when a series of resolutions dealing with the subject were drawn up by a committee composed of distinguished men of many nations, which was appointed to formulate rules for the production of the maps, so as to ensure that they should be prepared upon a uniform system.

These resolutions were approved at a general meeting of the Geneva Congress, and were forwarded by the Swiss Government to the British Government for consideration, whereupon the latter issued invitations to the Governments of Austria-Hungary, France, Germany, Japan, Russia, Italy, Spain, and the United States of North America, asking them to nominate delegates to act as the members of an International Committee to meet in London and debate the question. This Committee assembled at the Foreign Office in November, 1909, and Colonel S. C. N. Grant, C.M.G., then Director-General of the British Ordnance Survey, was appointed President. The proceedings were opened by the Under-Secretary of State for Foreign Affairs, Sir Charles Hardinge, G.C.M.G., now Lord Hardinge, who, in his address, referred to the progress that had already been made with regard to the International Map, and expressed the hope, on behalf of the British Government, that the great undertaking might be brought to a satisfactory conclusion.

The main business before the Committee was to settle on the mode of execution of the map, especially as regards the size of the sheets, so as to ensure that adjacent sheets, published by different countries, should fit together; and also to settle upon the symbols, printing, and conventional signs to be used, in order that these should be uniform throughout. A series of revolutions, embodying the decisions arrived at concerning these various points, was approved and drawn up in English, French, and German, the first of these languages being taken as the authoritative text. As the map was to embrace the whole surface of the globe, the method of projection to be adopted was, of course, a very important consideration, and, after due deliberation, it was decided that a modified polyconic projection, with the meridians shown as straight lines, and with each sheet plotted independently on its central meridian, would prove the most satisfactory.

The surface of the sphere was divided into zones, each containing four degrees of latitude, commencing at the equator, and extending to 88° N., and 88° S. lat. There were thus twenty-two zones on each side of the equator, and these were distinguished by the letters A to V north, and A to V south. This fixed the height of each sheet. For the width of the sheets, the surface of the sphere was divided into sixty segments, each containing six degrees of longitude, and numbered consecutively from one to sixty, commencing at longitude 180°. This arrangement made each sheet contain six degrees of longitude by four degrees of latitude; but, as the width of the sheets diminished as they approached the poles, it was decided that, beyond 60° N., or 60° S., two or more sheets could be combined. Each sheet could thus be given a clear identification number defining its position on the surface of the globe, without it being necessary to mention the country included in it, or the latitude and longitude. For example, the sheet containing the central part of England is called North, N. 30.

In order to ensure that the execution of all the maps should be identical, a scheme of lettering and of conventional topographical signs was drawn up and attached to the resolutions; and it was decided that a scale of kilometres should be shown on each sheet, and also a scale of the national measure of length of the

country concerned. As regards the representations of altitude, it was arranged that contours should be shown at vertical intervals of 100 metres, or at smaller intervals in the case of very flat, and larger in the case of steep ground, the height being measured from mean sea-level, as determined in the case of each country; while the levels of the surface of the country were to be indicated by a scale of colour tints, the colours being green from 0 to 300 metres, brown from 300 to 2500 metres, and purple above 2500 metres. In the same manner the depths of the ocean and of large lakes were to be indicated by varying tints of blue, so as to show intervals of 100 metres. In order to ensure uniformity in the scale of colours to be used, a copy of it, as approved by the Committee, was included in the plate of topographical symbols.

The whole scheme was thoroughly well worked out, and great credit is due to the members of the International Committee for the manner in which they carried out their difficult task. Since the meeting of the Committee in 1909 the preparation of the sheets, in accordance with the principles decided upon, has been taken in hand in several countries, and a number of these have been issued, which give a good idea of what this great map, the largest ever contemplated, will be like. These sheets deserve to be carefully studied, and will doubtless be the subject of considerable criticism, as there are several points which seem worthy of examination.

In the first place, it is for consideration whether it would not have been better if the colour scheme for representing differences of altitude had been omitted, as it is doubtful whether the advantage of the result gained is commensurate with the increased cost of printing the colours. And one naturally asks for what purpose is the map intended. Is it for the use of skilled geographers, of whom there are a comparatively small number in each country, or is it for the instruction of ordinary people? If it is for the latter, it is to be feared that the colour scheme will give rise to erroneous impressions. Compare, for example, Sheet North, M 31, of France, with Sheet South, H 34, of part of South Africa. In the former, as the greater part of the country shown is less than 300 metres above the sea, the general colour of the sheet is green, while in the latter, as nearly the whole of the country included has an altitude of more than 300 metres, the map is for the most part brown. This to the less educated man will probably convey the idea that, while France is a fertile country, South Africa is a desert. The fact, too, that the darker tint of green represents the lower level and the lighter the higher, while, in the case of the brown, the lighter represents the lower and the darker the higher, and, in the case of the purple, the relative strength of the tints is again reversed, is rather confusing.

There is another point as regards the colour scheme which might be noticed—that is, that it is not the same on different sheets. For example, the scale of tints adopted in Sheet North, O 30 (Scotland), North, M 31 (France), and North, K 35 (Turkey), do not correspond. In the Scotch map the brown colour commences at an altitude of 200 metres, in the French at 300 metres, and in the Turkish at 400 metres. There may be some reason for this, but it appears not to be in accord with the resolutions of the Committee. Another reason for omitting the colour scheme for altitudes is that it might be better to keep colour-work for other purposes, such as indicating political divisions, as there can be little doubt that so good a map as this, when completed, will be largely used for many purposes. It might be better that on a map of this small scale only the horizontal features, such as coast-lines, river-courses, railways, roads, and the position of towns should be shown, while to represent height graphically tends to obscure the former.

Another criticism I would venture to make is that the resolutions of the

Committee appear to have been drawn up on the supposition that the whole world has been accurately surveyed, and no attempt seems to have been made to distinguish between those regions of which the maps are based on triangulation, such as England and parts of Europe, and the countries of which complete surveys have not yet been made. As the construction of the map proceeds and sheets are prepared of parts of the world our knowledge of which is imperfect, this want will become more pressing, but it is noticeable even with regard to the sheets already published. It is one of the evils of cartography that where anything is shown on a carefully engraved map it comes to be regarded as true, and, if it afterwards turns out to be erroneous, it is not easy to get it altered.

The scale of the map, $\frac{1}{1000000}$, appears to have been wisely chosen, as it is sufficiently large to give an adequate amount of detail, while, at the same time, the sheets will not be unduly numerous. Of course, for an international map a cadastral scale was essential, although for national maps a scale based upon the national system of measures is more convenient, as, for example, in the United Kingdom, where the scales of 1 inch and 6 inches to the mile are better than scales of $\frac{1}{500000}$ and $\frac{1}{10000}$ would have been. They are more suited for the majority of individuals, and an ordinary foot rule can be used for measuring distances, instead of having to take them off with a pair of dividers from the printed scale on the map.

Looked at from the general point of view, there can be no doubt that the International Map is a most important and valuable undertaking. It is satisfactory that such a leading part in the matter has been taken by the British officers of the Royal Engineers and by the Royal Geographical Society.

In speaking of this map I have referred to the advisability, if not the necessity, of distinguishing between what is accurately and what is inaccurately known, and this brings me to another matter of considerable interest—the preparation of maps based upon the observations and information collected by explorers in unknown or little-known countries. To these explorers, some of whom have not been trained in geographical science, a large amount of detail shown upon modern maps is due, and it is only a small proportion of the land surface of the globe that has, up to the present, been surveyed in a scientific manner.

It is therefore of the greatest importance that the best value possible should be obtained from the work done by explorers, and this in the past has not always been sufficiently attended to, though during the last few years it is better understood. The people who stop at home in comfortable ease do not sufficiently realize the difficulties under which the conscientious traveller works and gathers together information about the country he passes through. Formerly, he generally had to work out his own observations and compile his own maps, but now conditions in this respect have greatly improved, and when he brings home his observations, notes, and sketches he can hand them over to some body, such as the Royal Geographical Society, by whom they will be put in shape in a better manner than he could do it for himself. One has heard of an explorer in a little-known country sitting up all night after a hard day's work, working out his astronomical observations, and trying to put his rough surveys into shape. He would have done better to have gone to sleep and prepared himself by a good rest for the next day's journey. In fact, it would be better if an explorer never looked at the figures of an observation after he had recorded them, or read over the notes of his past work, confining himself to recording what he had actually seen day by day as accurately as circumstances permitted, and carefully distinguishing what he really saw from what he thought he had seen, or what he had heard.

It would be easy to adduce instances of the errors which have arisen from the neglect of such precautions. Perhaps one of the best known is that I have already alluded to, when James Bruce, a careful explorer, because he had made up his mind that the Blue Nile was the real Nile, passed the White Nile without taking the trouble to examine it, and recorded it as being a comparatively insignificant river. Then there was the case of Sir Samuel Baker, who, having reached the shores of the Albert Nyanza with great difficulty, relied too much on what he was told by the natives, and showed it on his map as extending many miles to the south of the equator. But great responsibility rests also upon those who have the task of compiling a map from the notes of an explorer, and the greatest care has to be taken to show only what is really known, and not what is uncertain. Geographers, whether in the field or in the drawing office, should always hold up before themselves a standard of accuracy higher than it is always easy to live up to.

Geography under its more ancient name of geometry is, of course, the mother of all sciences, although at the present time geometry has got a more narrow meaning, and is perhaps regarded by some as independent of geography, although really only a branch of it. The study of the Earth upon which they lived was to the ancient nations the most important of all studies, and it is interesting to trace how astronomy, mathematics, geology, and ethnology are all so interspersed with geography that it is difficult to separate them. It is satisfactory to note how from the very first the British Association has always recognized the great importance of geography, since the first meeting of the Association at Oxford in 1832, when Sir Roderick Murchison, so well known to fame, acted as President of the Geographical and Geological Section. These two sciences remained united in the same section until the meeting at Edinburgh in 1850, when Sir R. Murchison was again the President. But, at the next meeting at Ipswich in 1851, they were separated, and while Geology remained as the subject of section C, Geography, on account of its great importance, was made the subject of section E, and the science of ethnology was united with it. Sir R. Murchison was the first President of the new Geographical Section, and was afterwards President no fewer than six times of section E, showing the great importance attached by him to the study of the science of Geography. May I express the hope that the Presidents of the Section will endeavour in future to follow, however humbly, in the footsteps of that leader of science?

REVIEWS.

EUROPE.

The Geography of Iceland.

W. von Knebel. Island. Eine naturwissenschaftliche Studie. (Nach einem begonnenen Manuskript, Notizen und Bildern des Verstorbenen bearbeitet, fortgeführt und herausgegeben von Dr. Hans Reck.) Stuttgart, 1912. Pp. v. and 290, 28 Pls., 1 Map. *Price 7s. 6d.*

Iceland is a country of special interest to British geographers, as it is the chief link between the British Isles and Greenland and the Arctic regions, and as it shared in the early Cainozoic volcanic period which forms one of the most interesting chapters in the geography of Ireland and western Scotland.

The general geography of Iceland is best known from the prolonged investigations of Thoroddsen. His work on the volcanic history of Iceland has been supplemented by the valuable contributions of the late Dr. W. von Knebel, made with help from the Academy of Sciences of Berlin. This book was nearly completed before the author left in 1907 for the expedition to Iceland, during which he and his companion, the artist Rudloff, were lost on a small lake, which has been named the Knebelsee, in a caldron on Askja. They started to explore the lake in a small folding boat, but were never heard of again. Careful search was made by an expedition a year later, but no clue to the mystery of their disappearance was discovered. It is suggested that they were overwhelmed by a rock fall from the cliffs beside the lake.

The manuscript has been prepared by Dr. Hans Reck, who has been one of the most active investigators of Icelandic geology in recent years. It includes a tribute to Von Knebel by Prof. Branca.

Dr. von Knebel's book is, in the main, a general summary of Icelandic geography. It contains chapters on the exploration and discovery of Iceland, the history of the Icelandic people, and their literature, their present conditions, and the limited flora and fauna.

The largest part of the work is devoted to an account of the volcanic and glacial histories of Iceland. The summary of the geology is short and does not throw fresh light on the age of the fossil plants, on which depends the correlation of the Icelandic rocks and eruptions. The geological history of Iceland contains no pre-Cainozoic rocks, and the determination of the age of its older rocks depends on the age of some fossil plants which were described by Heer. The re-examination of this evidence by a competent expert would be very valuable, for the dates of the chief incidents are regarded by Thoroddsen as older than they are by some more recent students, such as Pjeturss.

The most important section of the work deals with the volcanic phenomena. The author describes the geysers and the geyser-fields, and these are illustrated by a series of excellent coloured plates after sketches by von Knebel. The geysers are, however, now so irregular, that the author himself did not see an eruption.

The chapter on fissure eruptions is of special interest. He regards them as normal eruptions from a line of vents, and not as due to the quiet non-explosive discharge of lava in sheets from a fissure, which was open to the surface for considerable distances. Iceland is traversed by two systems of subterranean fissures. Von Knebel therefore used the term "fissure eruption" very differently from its original meaning. The Icelandic volcanoes are apt to be very explosive, and the author describes an interesting series of explosion craters.

An appendix gives a list of the recent literature of Iceland and hints as to the best means and expense of travel. The book is illustrated by twenty-eight plates of excellent photographs and a sketch-map after Thoroddsen. The author adopts very moderate views on glacial erosion, and attributes the trough-shaped valleys largely to sub-glacial water, and the valleys themselves to water-erosion in pre-glacial or inter-glacial periods. The influence of marine abrasion in the formation of the surface of the plateaus is not forgotten. The book is an admirable introduction to the study of Icelandic geography, and shows that the author's tragic death has robbed science of a promising student.

J. W. G.

'Survey of Oxford.' By Rev. H. Salter. (London: Henry Frowde. 1912. Pp. 82. *Maps and Plans.* 2*s.*) The survey which is here printed, accompanied by a species of directory, is taken from a record in private hands, and

forms an interesting guide to the topography of Oxford, which has so much changed in detail even since the date of this eighteenth-century work.

'The Oxford Country.' Edited by R. T. Günther. (London: Murray. 1912. Pp. xvi., 319. *Illustration, Maps, and Diagrams.* 7*s.* 6*d.*) This volume consists of a series of articles which have appeared from time to time in the *Oxford Magazine*, the *Oxford Chronicle*, and elsewhere, by various writers, whose names will be well known to students of the special subjects with which they deal, on various aspects of the country surrounding Oxford—geology, history, botany, and zoology, all find a place among these articles, which attain a high literary standard and fully reveal the many attractions of this part of rural England. So many of the alumni of Oxford (not in the School of Geography alone) are ready to follow in the steps of these writers, that it is well that the collection should have been made with the affectionate care which has been bestowed upon it by its editor.

'The Tobermory Argosy: a Problem of the Spanish Armada.' By R. P. Hardie. (London: Oliver & Boyd. 1912. Pp. vii., 68. 1*s.*) The records of this well-known wreck of a vessel of the Spanish Armada, which lies in the Bay of Tobermory, and from time to time has been the scene of attempts to recover treasure from it, are here critically examined with results which treasure seekers, at any rate, will hardly view with satisfaction. It is an interesting endeavour, controverting in many respects others which have preceded it, to identify the ship exactly, and to trace the sequence of events which led to its disaster.

'Rambles in the Pyrenees and the adjacent districts.' By Hamilton Jackson. (London: Murray. 1912. Pp. xii., 419. *Illustrations and Plans.* 21*s.*) Mr. Jackson has here produced a very beautiful volume, in which the leading feature of both the text and the illustrations is the close architectural study of many of the most interesting buildings which survive in Pyrenean towns and the adjacent country. General description and history, however, of this district and these places are also to be found here. It may be added that the book is concerned, for the most part, with the French flank of the mountains.

'Santiago.' By G. C. Gallichan. "Mediæval Towns" Series. (London: Dent. 1912. Pp. xii., 332. *Illustrations, Maps, and Plans.* 4*s.* 6*d.*) This volume on the city of Santiago perhaps enters more closely into detailed description than others in the series which have recently come under notice, and from the point of view of those who visit or who are already acquainted with the city, it does not suffer on that account. The history, however, receives adequate treatment, and the study of the great pilgrimages for which the city was famous is full of interest, and the various buildings which are associated with them are closely described, as also are certain of the routes followed by the pilgrims. The volume, as usual, is copiously illustrated in accordance with the excellent standard of the series, from drawings by Mr. F. H. Mason in line, and with half-tones.

AFRICA.

France in North Africa.

'La Colonization Française dans l'Afrique du Nord: Algerie, Tunisie, Maroc.' By Victor Piquet. Paris: Librairie Armand Colin. 1912. Pp. 538. 6 *fr.*

In this comprehensive volume, M. Piquet continues his researches into the political history of what may be described as French North Africa, and describes very fully the development of Algeria, Tunis, and Morocco since the historic episode of the Fan. The commercial and economical expansion of these countries is dealt with by a sure hand, and though the book is no doubt of more value

to politicians, men of affairs, and historical students than to the geographer, the many questions which are exhaustively discussed in M. Picquet's volume should increase materially the reader's knowledge of the historical and political geography of the French North African littoral, especially Algeria. The results of the French occupation of Tunis are adequately, but less fully, dealt with, and there is an illuminating comparison between the relation of the French officials with the natives in Algeria and Tunisia respectively.

The inclusion of Morocco in a work dealing with French colonization in North Africa is significant at the present juncture. It inferentially indicates that the so-called Protectorate recently declared over this "distressful country" is interpreted very liberally. It would seem that in the author's opinion this is merely the first phase of a colonizing policy which will eventually bring the whole of the North African littoral, from Casablanca to the Tripoli frontier, under the French flag.

East Central Africa.

'Through the Heart of Africa.' Being an account of a journey . . . from Northern Rhodesia . . . to Egypt. By Frank H. Mellard and Edward H. Cholmeley. London: Constable & Co. 1912. *Illustrations and Sketch-map.* 12s. 6d. *net.*

The journey from the Cape to Cairo along the usual track is fast losing its novelty, and a little library of volumes is accumulating describing the experiences of those who have trekked across Africa in a north-and-south line. From the ordinary run of such narratives, that of Messrs. Melland and Cholmeley stands out for excellence of style, and the amount of new and valuable information given, especially with respect to ethnology. This is partly because the authors diverged as far as possible from the line mainly followed by trans-African travellers. Officials of the Northern Rhodesia administration, both men of experience, and both with an understanding of and sympathy with the native point of view, they spent part of their leave in 1910 in returning overland. They chose a route through German East Africa which, beginning at the south-east corner of Tanganyika, led *viâ* Lake Rukwa (or Ikwa as they indifferently call it) to Tabora, and thence to Mwanga on Victoria Nyanza. Later in their journey, instead of going from Albert Nyanza by boat to Nimule, they marched overland from Foweira through the very little-known Lango and Acholi districts. In these last-named regions there was room for survey work, but the authors had, they explain, no time even for making sketch-maps. It appears to have been their one dereliction from the duty of the complete traveller. They give, however, a welcome account of the Lango, and a slight sketch of the Acholi; both tribes good types of the independent, alert, quick-minded, unspoiled savage. These tribes are being brought under control by the Uganda government, chiefly through the means of (underpaid) Baganda agents—a system which has many inherent difficulties and dangers. Perhaps the most remarkable thing about both Lango and Acholi is their ardour for military exercise. These "savages" execute manœuvres, copied from the drill of the Uganda troops, with surprising verve and exactness. Here is evidently the making of a fine fighting force.

Of as great, if not greater, value is the account Messrs. Mellard and Cholmeley give of some of the Bantu tribes of the south-east Tanganyika district, notably the Wakuluwe and the Wakwa, of Rukwa. The Wakuluwe, whose chiefs at least are of Hamitic origin, are interesting in many ways, and full accounts are given of their marriage and death ceremonies. The comparative purity of their religion, which is distinctly theistic, is noteworthy. Their beliefs, set out at some length, have singular points of resemblance to the "higher"

religions of antiquity. They presumably date from the Hamitic migration, and probably originated in Asia. The Wakwa are "frankly pagan." They make large flat loaves of bread, which before being eaten serve as trays. These flat loaves were made by no other tribe encountered. A delicacy among the Wakwa is the rat, which is eaten, "skin, hair, and all."

While the ethnological information is the most important new contribution to knowledge given in the book, we get from it also a clear conception of the nature and resources of the country traversed, and some very shrewd observations on German and British methods of government. The Germans appear to be doing well, especially since Herr Dernburg largely abolished military rule. In Uganda the chief defect of the administration is declared to be the constant shifting of officials from one district to another. Ample testimony is borne to the remarkable progress made by the Baganda (though the authors prefer the unsophisticated Lango), and the general impression left by this excellent book is that the African Negro has a considerable future. Incidentally and implicitly, it can be seen what a great power for good are the missionaries, both Protestant and Roman Catholic.

The sportsman will find several chapters descriptive of elephant hunting near Albert Nyanza and in the Masindi district. The illustrations are clear, numerous, and well chosen.

F. R. C.

South Kamerun.

'La Mission Cottes au Sud-Cameroun (1905–1908).' Par le Capitaine A. Cottes. Preface par André Tardieu. Paris: Ernest Leroux. 1911. 80 *Plates and* 6 *Maps.* 7 *fr.* 50.

The work of the French and German missions which, under Captain Cottes and Captain Foerster respectively, fixed the boundary between Southern Kamerun and the French Congo has been, as far as the frontier line is concerned, superseded by the carrying of the German frontier further south in accordance with the agreement of 1911. To that extent the exertions of Captain Cottes and his comrades represent "love's labour lost," but to that extent only, for it is no mean achievement to have mapped accurately a large area of almost unknown country in addition to gathering precise information concerning the people and products of the region. M. André Tardieu, in a prefatory notice, observes that as a result of the transfer of the territory to Germany, Captain Cottes' narrative has about it the melancholy of dead things. It has rather the lively interest of a chapter of recent history.

Captain Cottes' book is a model of lucidity, and also a striking testimony to the thoroughness and ability with which he fulfilled his task. He begins by a sketch of the previous agreements affecting the territory; next he narrates the work of the mission. This is followed by a description of the country along the frontier line. A separate chapter is devoted to the still little-known Spanish Guinea. The inhabitants are treated in some detail, the geographical distribution and approximate numbers of each of the important families being given. This general account of the natives is supplemented in the second part of the volume by detailed and valuable anthropological information obtained by Dr. Gravot, and put into shape by Dr. Poutrin. Ethnographic and linguistic notes are also supplied by Dr. Poutrin, while flora and fauna are treated by other authorities.

This volume gives an excellent idea of the kind of work the explorers of to-day, who can have no great discovery to chronicle, accomplish. The

general character of the land along the (former) southern Kamerun frontier can be summed up in three sentences, "The country is mountainous in the neighbourhood of the river Ngoko; marshy, and cut by numerous streams between Suangie and 9° E. of Paris. According to the season of the year, travelling is more or less arduous in consequence of the rains, but never very easy. The very dense virgin forest extends without interruption from the Sanga to the sea." But this general outline is filled in with minute care, so that we gain a thorough knowledge of one corner of Africa. Specially interesting are the notes on the Fan, which show what an important part they must play in the economic development of the country. The illustrations are of unusual excellence.

F. R. C.

'Alone in West Africa.' By Mary Gaunt. (London: T. Werner Laurie. 1912. *Illustrations.* 15*s. net.*) Mrs. Gaunt visited the Gambia—of which she gives an excellent impressionist sketch—touched at Sierra Leone and some Liberian ports, traversed the Gold Coast on a line parallel with the sea, turned inland up the Volta, crossed into Togoland, returned to the Gold Coast, thence journeying to Ashanti previous to her home-coming. Though scarcely at any time out of touch with a white settlement, the journey was a plucky and an adventurous undertaking. If her book does not add directly to the sum of geographical knowledge, it is likely to increase the average man's and woman's knowledge of the West Coast, for its lively style and its pertinent criticisms of British methods of administration will gain it many readers, who would pass by more solid sources of information. Mrs. Gaunt's point of view is often original (and sometimes superficial); her comments on native life, the value of missions, the need of wives for officials—wives on the spot, not in England—all these things challenge attention, and as frequently as not will provoke dissent from the author's view in the minds of those more familiar with West Africa than is Mrs. Gaunt. But no one will find the book tedious.

'The Land of Goshen.' By R. H. Brown. (London: Edward Stanford. 1912. Pp. 92. *Maps.* 3s.) In this second edition of his work on the flight of the Israelites from Egypt as far as the supposed site of Elim on the east shore of the Arabian gulf, the author has the opportunity of discussing views which have been expressed subsequently to the original publication of his work. He accounts in an interesting manner by means of natural phenomena for various events which in the original narrative bear the appearance of the supernatural; among these are included the crossing of the Red sea and the disaster to the Egyptians there. The maps indicate the supposed northward extension at the period of the exodus of the Arabian gulf as far as Lake Timsah.

AMERICA.

South American Archæology.

'South American Archæology: an Introduction to the Archæology of the South American Continent, with Special Reference to the Early History of Peru.' By Thomas A. Joyce. London: Macmillan & Co., and Philip Lee Warner. 1912. 12*s.* 6*d. net.*

Mr. Joyce, of the British Museum, has distinguished himself in several fields of anthropology, and now he has put another group of students under obligation to him. South American archæology up to the present time could only be studied by tedious reference to scattered original communications in diverse languages; for the first time we have a general review of the subject. The following is the

order of treatment: Colombia, Ecuador, Peru (growth of the Peruvian empire, government, daily life and occupations, burial, religion, sequence of cultures, arts and crafts, the southern provinces), the Southern Andes and Plains, East and Central South America, and a brief Appendix which points out gaps in our knowledge and gives a short descriptive bibliography. Colombia, with a diversity of geographical conditions, possessed, when the Spaniards arrived, a large number of tribes representing various stages of cultural development; of these the Chibcha were the most civilized, and a feature of their "mythological history is one common to all cultured peoples of Central and South America, namely, the arrival of a white culture hero who gave the people laws and instructed them in arts and industries." Although their empire was almost contiguous in the south with that of the Inca, their civilization was quite distinct from that of the Quichua, and they retained their independence until the arrival of the Conquistadores. Though the respective cultures of the Colombian tribes differed in detail, yet underlying was a strong similarity which extended also to the culture of the Peruvian highlands. "If the Chibcha may be regarded as illustrating in broad outline the condition of the Peruvian tribe before the people of Cuzco had established their hegemony, the small empire of Quito [in Ecuador] may equally be taken to represent the Inca empire in its infancy." The greater part of the book is naturally taken up by the account of Peru, and it forms a most admirable summary of our knowledge; the reader should at the same time consult Sir Clements Markham's 'The Incas of Peru,' and Payne's suggestive 'History of the New World called America' should not be neglected. In the southern provinces Inca influence was weak and disappeared in the southern section of Chile and of the Argentine; agriculture was less practised to the south. "The social system of the peoples of this region affords a remarkable contrast to that of the almost over-regulated country over which the Inca ruled. Though in the main patriarchal, as is usual among nomadic peoples, its leading features were individual freedom and equality." Although the area of East and Central South America is vast and relatively speaking very little is known of its archæology, "yet the researches made seem to point to a culture which is fairly homogeneous, belonging to a low evolutionary stage and of no great antiquity." In discussing the various ancient cultures, Mr. Joyce, as far as his space permitted, has taken varied evidence into account, and has not neglected the data afforded by craniology, but he has naturally given a good deal of prominence to the pottery finds, and his descriptions of the technique and decoration of the pottery give an especial value to the book. The volume is well illustrated with 26 half-tone plates, 1 plate in colours, 37 figures in the text, and 2 maps.

A. C. H.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

METEOROLOGY.

'Our Weather.' By J. S. Fowler and William Marriott. *Maps, Photographs, and Illustrations.* London: J. M. Dent & Sons. 1911. 1*s. net.*

This useful and well-illustrated little volume is one of the "Temple Primers," and familiar as is its elementary subject-matter a great deal of information is placed before the reader in a new and attractive way. The authors, moreover, have apparently realized that the best way of whetting the appetite of the unscientific public for a scientific study is to introduce judiciously the popular aspect of the subject here and there. They have, in fact, been good enough to give their readers a pleasant little introduction in a lively comparison of the

effects of the weather on the temper of your friend as he meets you on the road in the morniug. On p. 54 one finds a table of the average monthly rainfall at the Royal Observatory, Greenwich, which is interesting to compare with one of the average monthly evaporation at the same place. The average annual rainfall is 24·32 inches, ranging from 2·71 inches in October to 1·52 inches in March, whilst the yearly evaporation amounts to 15·65 inches, being greatest (3·16 inches) in the warm month of July, when it exceeds the rainfall by 1·71 inches, and least (0·09) in December, when it is in defect of the rainfall to the amount of 1·86 inches.

Owing apparently to the fact that evaporation is an invisible process and less striking in its immediate effects than precipitation, comparatively little attention has as yet been paid to its scientific measurement. Systematic observations upon evaporation, on a scale analogous to that on which rainfall measurements are made, are needed to give the latter their true practical signification, and it is obvious how important such results would be to engineers and others. The photographs reproduced in this little book are excellent, such as those of forked lightning and one showing sheep killed beneath an oak. The last chapter on weather lore discusses the value of various common proverbs.

L. C. W. B.

Atmospheric Circulation.

'Contribution à l'Étude des Relations existant entre les Circulations Atmosphériques, l'Electricité Atmosphérique et le Magnétisme Terrestre.' Par Alfred Vialay. *Maps and Illustrations.* Paris: H. Dunod et E. Pinat. 1911.

This treatise goes somewhat fully into the details of the general summer and winter circulation of the atmosphere over the globe, and in it are drawn conclusions not always in accordance with more usual or generally accepted notions. It thus deserves the careful consideration of all students of the subject, but to us this work, like so many French discussions of a like character, seems somewhat barren owing to the merely verbal reasoning employed, which can seldom get very far without the more rigorous methods of mathematics. The author disagrees with Sir John Eliot's view of the source of the south-west monsoon of India. The latter considers the monsoon to be supplied by the south-east trade wind, which is on this supposition drawn across the equator. M. Vialay concludes, on the contrary, that the winds which bring the all-important summer rain to India are currents deflected northwards from the main body of the north-east trade wind, which in part lies a little south of the equator at this season. He affords some negative evidence against Eliot's theory together with positive evidence in support of his own. According to M. Vialay's scheme, drought and famine in India should synchronize with a poor flood of the Nile, and abundant rains with a high flood, and such a relationship has in fact been discovered by Sir W. Willcocks and Sir John Eliot himself. The author is further of opinion that an extension of the north polar ice area farther south in summer than usual will weaken the summer system of circulation over the Asiatic and American continents, and thus indirectly the strength of the south-west monsoon. In a discussion in Chapter VII. upon the effect of pressure distribution on the weather in France, M. Vialay shows that the same general conditions which in December 1879 brought to France winter of extreme rigour, in April 1893 were associated with heat and drought, the difference being, of course, entirely due to the change of season from the shortest days in the year to a period when the days are already long and warm.

L. C. W. B.

GENERAL.

Map-making for Schools.

'Maps: How they are made, and how to read them.' By H. N. Dickson, M.A., D.SC., Oxon., Professor of Geography, University College, Reading. London: G. W. Bacon & Co., Ltd. 1912. *Price* 6*d*.

This little book is specially suitable for teaching the elements of the construction and reading of maps in schools, for which purpose it has evidently been prepared. It consists altogether of sixty-six pages, and is divided into three chapters, the first of which deals very briefly, in the simplest possible manner, with principles of surveying and the determination of latitude and longitude; the second with scales of maps, projections, contouring, and other matters connected with map-construction; while the third has reference to the important subject of map-making, and shows by clear little diagrams and concisely written explanations the meaning of conventional signs and some of the ordinary methods of representing various land forms by contours. This chapter is specially good and instructive so far as it goes, and it is hoped that a young student will be sufficiently interested in the subject to follow it up more seriously later on. Dr. Dickson has certainly done his best to create an interest in the matter by his little book, which deserves to be brought to the notice of those who desire to instruct children in practical geography on more enlightened lines. The price is doubtless made exceptionally low so as to bring it within the reach of all. Some of the explanations are perhaps not full enough to make matters quite clear, and a few of the diagrams might be improved without increasing the cost of production; for instance, that on page 23 is part plan and part a perspective sketch, so that at first it is difficult to make out what is meant. Perhaps a fault to be found is that the book is somewhat too condensed and curtailed, and in another edition it might be well to slightly expand certain sections.

'Britain in the Tropics: 1527–1910.' By A. Wyatt Tilby. (London: Constable. 1912. Pp. viii., 452. 6*s*.) 'American Colonies: 1583–1763.' By A. Wyatt Tilby. (London: Constable. 1912. Pp. x., 302. 4*s*. 6*d*.) In his volume on 'Britain in the Tropics,' the author has made a notable addition to the series on the English People Over-seas, to the earlier volumes of which reference has previously been made in these pages. The main purpose of his work is historical, but he appreciates and draws the distinction between the tropical colonies, which are solely exploited for commercial purposes, and administered by a few white men, and the temperate colonies, where vacant lands are available for white settlement, and have been primarily acquired for that purpose. The other volume under notice is a second edition, which has received careful revision. For the purpose of reference to individual points, which these volumes would otherwise excellently serve, the addition of indices might be recommended.

'Histoire de l'Expansion Coloniale des Peuples Européens de la Néerlande et du Danemark, XVII^{e} et XVIII^{e} siècles.' By Charles De Lannoy and Herman van der Linden. (Brussels: Henri Lamertin. 1911. Pp. vi., 487. *Maps*.) In this volume the geographical positions of the mother countries are studied with particular reference to their bearing upon over-sea expansion. Besides the history of that expansion within the period named in the title—the seventeenth and eighteenth centuries, the administrative systems of the colonies are considered, and also their economic conditions, while special chapters are devoted to the effect which the progress of colonization had upon the mother countries

themselves. The volume contains a few simple maps sufficient to enable the text to be followed.

'La Terre: Géographie Générale.' Par P. Camena d'Almeida. (Paris: Armand Colin. 1909. *Maps and Illustrations.*) This text-book, designed to meet the requirements of secondary education in France, is pleasantly written and attractively illustrated. The arrangement is good, the volume being divided into three "books," the first dealing with general, the second with physical, and the third with human geography, while the volume concludes with a revision of the subject-matter. The one inconsistency in the arrangement which we have noticed is in Section VI. ("Les eaux courantes") of Book II., where snow is dealt with instead of in Section V., where rain and the diverse atmospheric phenomena are studied. We are glad to note the large amount of space devoted to economic geography in the third part of the book, which is full of interesting reflections and useful knowledge. The discussion of the distribution of religious creeds (pp. 484 *et seq.*) is more scientific than that in many text-books. Whilst emphasizing, however, the primary division of European Christianity into Roman Catholicism claiming 225 millions of adherents, Protestantism with 150 millions, and Greek Orthodoxy with 100, the author fails to mention the distinct localization of these different forms of Christianity, and to point out that the spread of Protestantism in the north of Europe and the persistence of Roman Catholicism mainly in the south are largely, if not chiefly, adaptations to differences of racial and national temperament as affected by climatic environment.

'Rocks and their Origin.' By G. A. J. Cole. (Cambridge University Press. 1912. Pp. viii., 175. *Illustrations.* 1*s.*) 'Civilization in Palestine.' By R. A. S. Macalister. (The same. Pp. viii., 139. *Maps and Illustrations.* 1*s.*) 'Ancient Assyria.' By C. H. W. Johns. (The same. Pp. ii., 175. *Maps and Illustrations.* 1*s.*) In the first of these three volumes of the 'Cambridge Manuals of Science and Literature,' Prof. Grenville Cole describes the character of various rock formations and assigns them to the various origins, in a manner easily intelligible to those to whom the volume is addressed; it is one which might well accompany any traveller who takes an interest in the physical conditions of the land, and he will find frequent references to specific examples of the various rock formations from different countries. By way of annotation to the text a copious bibliography is provided. The list of minerals forming rocks at the outset of the book may be somewhat beyond the understanding of the general reader, and in some instances a technical term here and there, which may be unfamiliar to him, passes without explanation, though within the narrow limits of space available this could scarcely be avoided. The other two volumes under notice bear the high authority associated with each contribution to the series. Both are excellently clear in arrangement. The system of transliteration adopted in the volume on Assyria may not always commend itself to the ordinary reader without explanation. All three volumes are suitably illustrated, and the two last have maps sufficiently detailed to enable the text to be properly followed.

THE MONTHLY RECORD.

EUROPE.

The Fourth Seasonal Cruise of the "Najade" in the Adriatic in 1911.—We have already referred to the three earlier cruises of the Austrian research vessel *Najade*, undertaken in co-operation with the Italian organization for the

study of the Adriatic, with a view to ascertaining the varying conditions of that sea at the different seasons of the year (see *Journal*, vol. **38**, p. 322; **39**, pp. 80, 497). The series was completed by a cruise begun on November 16, of which a brief account has been given by Dr. A. Grund in the *Mitteilungen* of the Vienna Geographical Society (1912, No. 4). On this occasion the co-operation of the Italian ship, the *Ciclope*, was impossible owing to the war in Tripoli, and by agreement with the Italian committee the work of the *Najade* was extended so as to include profile No. 8 across the Strait of Otranto. The soundings along the 7th profile generally confirmed the previous results, but as that in the position of the hitherto supposed greatest depth was made under more favourable conditions, the result is to be preferred to the previous one. It gave a depth of 1094 metres (598 fathoms) in place of 1128 metres. On profile No. 6, between Bari and Ragusa, where 1260 metres had been obtained before, the new sounding showed only 1200 metres (656 fathoms). If this also is taken as more reliable than the earlier result, the deepest portion of the Adriatic will probably be in the neighbourhood of a sounding of 1223 metres (669 fathoms), obtained in 42° 3·8′ N., 17° 41·3′ E. At the time of the cruise, the sea was in process of cooling by vertical convection currents, the influence of which was to be traced in the three northern profiles to a depth of 20–50 metres. To this depth both the temperature and salinity were virtually constant. In the south the same effect could be traced only to 5 or 10 metres. The variation of density in the surface layers was here very great, the coast-water derived from the Albanian rivers covering almost the whole southern half of the southern basin. Further north the water with a salinity of over 38 per cent. extended as far as profile No. 2, coast-water again appearing in any quantity only in the Gulf of Venice. As compared with May, the temperature contrast between the east and west sides was reversed, the east being now warmer than the west by 2–2½° C. (3·6°–4·5° Fahr.) and more. Whereas in the upper layers the temperature was everywhere lower than in August, both the temperature and salinity of the lower layers had now risen everywhere, owing both to convection from above and to influx from the south. Only the deep basins, particularly that of Pomo, now showed the bottom water of winter.

ASIA.

Scientific Work in India, 1910-11.—The recently issued 'Annual Report of the Board of Scientific Advice for India' records satisfactory progress in the various branches of scientific research carried out under official auspices. Reporting on geodesy, Mr. J. Eccles states that work for the Principal Triangulation was carried out in Burma, Kashmir, and Central India. In Kashmir, the new Principal Series had been extended some 60 miles northward by means of two quadrilaterals, the eight completed triangles having an average triangular error of 0·69 inches. The observations at all stations were taken with a two-microscope 12-inch theodolite, a decided loss of accuracy having resulted from the use of an 8-inch instrument for mountain work at the end of the previous season. Lieut. Bell * and Mr. Wainwright had started to reconnoitre the country north of Gilgit, in order to test the feasibility of connecting the triangulation with Russian work. The observations of Mr. Collins for the determination of the true position and height of Teram Kangri have already been referred to in the *Journal* (vol. **39**, p. 71). Being based on work with the plane-table and aneroid, the height of 24,272 feet assigned to the peak in the report has since been replaced by the later result quoted by Dr. Longstaff (*loc. cit.*). Astronomical

* The premature death of this promising officer has lately been reported.

latitudes had been determined at stations in Sind and Baluchistan, as well as in the Siwaliks, those in Sind being the first taken in that region. A comparison with the geodetic latitudes shows a negative value of A – G, and consequently a northerly attraction of the plumb-line; the relative values of the deflections indicating a structure similar to that at the foot of the Himalayas, namely, a trough of low density at the foot of the hills, succeeded at a considerable distance by a belt of abnormally high density. In the case of the Siwaliks the relative value of the deflections indicates that the approach to the Himalayas is a more important fact than the change from one side to the other of the lesser range. The year's work in Burma was interesting as affording the first gravity results yet obtained there. During the recess computations of the effect of the whole surface of the Earth on gravity at Indian stations were commenced, on the basis of Mr. Hayford's hypothesis in his isostatic inquiries, and it was hoped that the final computations would be completed without much delay. Other sections of the report deal, as usual, with meteorology, terrestrial magnetism, geology, botany, zoology, etc. One of the most important botanical explorations was in south-east Sikkim, by Mr. Smith, who, with Mr. Cave, had previously explored the extreme north-west of the same region. On the Chon La range summer was found to be short, with much rain in the form of steady drizzle, and a limited amount of sunshine. The flora was less varied than in northern Sikkim. Under the heading Economic Botany mention is made of efforts for the improvement of the Indian cotton crop, and a desideratum is said to be the establishment by the trade of suitable buying, ginning, and baling agencies at the door of the cultivator. At Pusa important results had been obtained in the direction of the production of new wheats by hybridization, the aim being the combination of high yield and high quality by crossing. By using suitable stocks wheats were obtained, in the third and fourth generation, which both bred absolutely true and combined the desired qualities, and which have been most favourably reported on for their behaviour in milling and baking.

Mrs. Workman's Explorations in the Himalaya.—The return of Mrs. Workman from her this year's expedition in the Karakoram Himalaya was announced early in September. She is said to have completed the exploration of the great Siachen glacier, the importance of which was first made known by Dr. Longstaff in 1909, besides effecting the first ascent of a high peak, and ascending four new passes between 18,000 and 21,000 feet in height. One of these leads from the Siachen to the hitherto unexplored Kondus glacier, by which latter the party returned. For six weeks all the camps are said to have been at an altitude exceeding 17,000 feet.

The Issyk Mountain Lake.—This lake, the Jasyl-kul, or Green lake of the Kirghiz, lying on the northern flank of the Trans-Ilian Alatau, due west of Verny and 30 miles distant from that town, was investigated in 1908–10 by Mr. A. Vinokurof (*Zemlevedeniye*, Nos. 1-2, 1911). The lake stands at a height of 5866 feet above sea-level and 3297 above Verny in an expansion of a ravine enclosed in crystalline rocks—felsite porphyry according to Mushketof—which rise to a height of 3300 feet above the water and are clothed with pine forests. The lake is fed almost exclusively by the glacier river Issyk, which forms a delta on the southern bank and flows out of the lake on the north beside a huge terminal moraine which has dammed up the basin. By a series of cascades the stream descends 272 feet and enters the Little Round lake (area 2335 square yards; depth in centre 161 feet), and then falls in a long cascade to the foot of the moraine. In summer the larger lake discharges 343 cubic feet of water per second, but in August the melting of the snow diminishes and at length the

lake ceases to overflow. In summer the area of the lake is more than one-third square mile, and the greatest depth, 171·5 feet, in the northern part, is not comparatively great. At the end of winter the area of the lake reaches its greatest contraction, to barely one-fifth square mile in 1908. In this year the surface fell 42 feet, in 1909 25 feet, while the Cossacks of the neighbourhood said that it fell 54 feet in 1885. The climate of the basin is very equable, the extreme temperatures being 71·6° and 21·2° as against 97·7° and − 4° in Verny. The maximum temperature of the water of the lake is 58°.

South-East Luzon.—Since the American occupation of the Philippines, steady progress has been made with the exploration of the less-known parts of the islands, chiefly by geological reconnaissance parties, who, as is usual in imperfectly surveyed countries, have been able also to throw much new light on the topography. A report on South-Western Luzon appeared in 1910 in the *Philippine Journal of Science* (Section A), and this has been followed (December 1911) by a similar account, by Messrs. G. I. Adams and W. E. Pratt, of a reconnaissance in the south-eastern peninsula. Except in the west, where it includes a continuation of the Eastern Cordillera of Central Luzon, this forms a distinct division of the island, both geologically and geographically, though both areas contain volcanic features of special interest. The dominant feature of south-eastern Luzon is a chain of volcanic peaks, extending in a north-west to south-east direction, and named by the authors the South-Eastern Cordillera. Parallel with this, to the south-west, stretch the Ragay coast hills, separated, however, towards their centre by the depression of the Bicol valley. On the east the Caramuan peninsula, and Catanduanes island which seems to be related to it, diverge from the central portion of the cordillera, and further south the Ratan island chain probably represents the exposed portions of a fault block lying on the Eastern flank of the Cordillera. The South-Eastern Cordillera is separated from the Eastern Cordillera by a lowland occupying the narrow neck which unites the south-eastern extremity to the rest of the island. The South-Eastern Cordillera is divided into three parts by the bays of San Miguel and Sorsogon, the most conspicuous volcanic peaks lying in the two more southern divisions. The central part includes Isarog, an extinct volcano, appearing dome-shaped from the west, though the great crater may be seen from the east through a deep cleft; and the beautiful and almost perfect cone of Mayon, whose symmetry as seen from a distance is most impressive. The southern part is dominated by Bulusan, thought by Jagor to be surprisingly like Vesuvius, though a closer inspection lessens the closeness of the analogy. The Caramuan peninsula has a very irregular north-east coast-line, bordered by islands, which gives the impression of having been "drowned."

AFRICA.

Results of the Anuak Expedition, Egyptian Sudan.—This expedition, carried out in March last for the chastisement of the unruly Anuak tribes in the Sobat basin, has added somewhat to our knowledge of an outlying district of the Egyptian Sudan. The country of the Anuaks, like that of their more peaceable neighbours the Nuers, for whose protection it was felt necessary to take in hand the recent expedition, had been traversed in part by explorers like Bòttego, Wellby, Austin, and others, but much of it remained imperfectly known. The objective of the column was Odonga, situated some 60 miles south-east from the junction of the Pibor and Akobo rivers, and this was reached after an eleven days' march, a successful fight with the enemy taking place the day before. According to a brief summary of the results of the expedition sent to

the *Times* by its correspondent in Cairo early in September, not a vestige of a stone or hill was seen either in the Nuer or Anuak district, the whole country being a level plain of black cotton soil. During the march from Akobo Post to Odonga it was found practically uninhabited.

The Saharan Railway Survey Expedition, under Captain Nieger, to which reference was made in the March number (vol. **39**, p. 284), has, according to reports received from time to time in France, made an entirely successful journey, and its several sections were thought to be returning to the coast before the end of August. From Colom-Beshar, the terminus of the Western Algerian railway, the party went south-south-east to Silet, at the foot of the Hoggar plateau, which was reached about the end of April. After joining here a small detachment from the Sudan which had come north to meet them, Captain Niéger and his coadjutors set out again in May in three parties, two of which, under Lieut. Laibe and the well-known geologist, M. Chudeau, respectively, were to make for the Niger by routes leading on either side of the massif of Adrar; while Captain Niéger took the route by Agades to Ngigmi on Lake Chad. The object of the divergence of the two western parties was to study the most feasible route for the proposed branch line to the Niger. It was announced in August that M. Chudeau and others had reached the Niger, and had started on the return journey by way of Dakar. The leader, with Captain Cortier and M. Monseran, was due to reach Ngigmi early in August, and would return *viâ* Kano and the British Nigerian railway.

The Tabora Railway.—The formal inauguration of the German railway from the coast at Dar-es-Salam to Tabora, traversing the central zone of German East Africa, took place on July 27 in the presence of a large number of Europeans and natives. The work had been pushed forward with great energy during the previous two or three years, and the long delays which hampered the early stages of the undertaking have thus been made up for. The prolongation of the line to Tanganyika is now assured, and the preliminary operations are already in progress. Some account of the line and its history was given in the *Journal*, vol. **37**, p. 563.

AMERICA.

Mr. Stefansson's Explorations in Northern Canada.—The return of Mr. Stefansson to Seattle, after completing four years' exploration and research on the Arctic shores of North America, was announced on September 10. The work accomplished has more than once been referred to in the *Journal* (vol. **38**, p. 626; vol. **39**, p. 399), particularly the interesting discovery of Eskimo tribes of an unusually white colour, with (in many cases) red hair and blue eyes, on the lands adjacent to Coronation gulf. It is now stated that thirteen tribes of these people were met with, probably numbering in all two thousand individuals, and that ten of the tribes had never heard of Europeans. Mr. Stefansson adheres to his theory that these people represent the descendants of early emigrants from Scandinavia to Greenland, who, as is well known, were long cut off from intercourse with Europe and eventually lost sight of. He says that in physical characters, including the shape of skull, they show no trace of the Mongolian type. They use bows made of willow and arrows tipped with flint or native copper. Their knives are of copper with horn handles, and are very similar to implements made by the early Norsemen. Bone needles are also used as in old days among the Norsemen. They are migratory, never remaining long in the same spot and never settling on the actual coast. They reside in large numbers in Victoria island, living on the caribou found in its interior in the summer, but moving on to the ice in winter and hunting seal. No opinion

can, of course, be expressed on this theory until the data have been fully studied and discussed by anthropologists.

The Interior of Vancouver Island.—Mrs. J. W. Henshaw writes from Buttles lake, Vancouver island, under date August 19, 1912, giving some account of a trip carried out by her, in company with Mr. Henshaw, into the little known interior of that island, into which few besides trappers and prospectors have hitherto penetrated. The difficulties of getting about are said to be enormous except where traits have been cut, the rivers being full of rapids and holes, and the bush of alder, willow, devil's club, and conifers, almost impenetrable. The travellers had approached the divide between the east coast and Buttles lake by way of Cornox lake, where an old trail leads up the west fork of the Cruikshank, over the top, and down Shepherd's creek, but it is so far obliterated, and the snowfields so immense, that it was necessary to go round the northern end of the range at McIvor lake. A new river, draining a superb snowfield, had been explored, and a fine series of falls visited, which last fell among rocks of polished green marble bordered by Maidenhair ferns and flowering shrubs. A reservation of 230,000 acres has been set apart by Government as a park, to be named Strathcona Park, and surveyors have lately been at work searching for a suitable route for a proposed road to it. Buttles lake is hemmed in by snow-capped peaks and at one spot rises a mass of red rock with seams of red-veined white marble which Mrs. Henshaw has named "Marble mountain."

The Buried Channel of the Lower Hudson.—Recent engineering works have thrown an interesting light on the form of the old channel of the lower Hudson before it was buried by later accumulations of material. In the first place, exploratory borings have been carried out by the Board of Water Supply of New York City, in connection with the great Catskill aqueduct by which the waters of Esopus creek are soon to be carried into the city. The earlier operations, described by Mr. J. F. Kemp in the *American Journal of Science* for October 1908, showed that such buried channels exist both in the main river and its tributaries, in the section between the Catskills and New York. The same writer now describes (*Amer. Journ. Sci.*, July, 1912) further borings made with a view to the crossing of the Hudson by a tunnel between Storm King mountain on the west bank and Breakneck mountain on the east. In 1908 a drill sent down in the middle of the river had reached a depth of 580 feet without passing beyond the deposit of boulders and sand; but the operations as carried on from a scow anchored in midstream proved so difficult that, after reaching 768 without striking bed-rock, another method was decided on. Drills were therefore sent down in a slanting direction from either bank until, according to calculations, they crossed below the centre of the river. Two successive pairs having crossed at about 1500 feet and 900 feet respectively below the surface, it was proved that solid granite was certainly present at 955 feet, and a depth of 1100 feet was therefore chosen for the crossing of the great siphon. The result is to show that the bed-rock of the Hudson at this point lies between 768 and 955 feet, and, on the assumption of a U-shaped profile, may be put at approximately 800 feet. Details are given of the nature of the rock traversed, which is almost entirely granite, forming a part of the large Storm King batholith. It is under compressive strain, as shown by its tendency to scale off in the tunnel with small explosions. Although jointed, it yields surprisingly little water. Some remarks are made in conclusion as to the origin of this buried channel—whether from water or ice erosion. Data are not available to show whether the deep channel is continued, with further drop, to

the sea. Drills have been put down opposite New York City by the engineers of the Pennsylvania Railroad, but without revealing a channel of more than 300 feet. There is room, however, for a deep notch to exist in the centre, between two neighbouring bores, and the question cannot therefore be definitely settled. Over-deepening by ice is favoured by the writer and his colleague as the mode of origin of the 800-foot channel, though another geologist to the Water Supply Board, Prof. W. O. Crosby, favours water-erosion. In this connection the facts which have been brought to light regarding the submarine cañon off the mouth of the Hudson should not be overlooked (cf. Prof. J. W. Spencer's paper in *Journal*, vol. 25, p. 180). That writer argued in favour of fluviatile erosion as the cause.

Railways of Bolivia.—The Annual Report for 1910–11 of the Bolivian Dirección General de Obras Publicas, lately received, contains, besides a report of progress in railway construction, a useful map of the railway system of the country, distinguishing clearly lines open for traffic, those under construction, those for which a survey of the ground is in progress, and those merely projected. At the time of writing, progress was being made (among others) with the lines from Oruro to Cochabamba, from Rio Mulatos to Potosi, from Uyuni to Tupiza in the direction of the Argentine frontier, and with those intended to supply a through connection between Arica on the Chilean coast and La Paz. The Uyuni-Tupiza line is of special importance, as it will supply, when carried on to the frontier at La Quiaca, a needed connection with the Argentine system, and so between the Atlantic and Pacific oceans. Several more or less ambitious projects are on foot, including one from Yacuiba on the Argentine frontier, east of La Quiaca, northward to Santa Cruz, with an extension to Puerto Velarde on the Mamore, as well as from Santo Cruz eastward to the Brazilian frontier at Puerto Suárez. Others are intended to supply communication with the extreme north-west, and with the Madeira by means of the Madeira-Mamore railway, now approaching its termination from the Brazilian side. From the direction of La Paz it has been proposed to construct a line or lines towards the Beni and Madre de Dios and even to the frontier on the Acre. But some of these schemes appear to be mere suggestions, and do not find a place on the map even among projected lines, not, at least, below Rurenabaque on the upper Beni. Other proposals are for lines from Potosi to Sucre, from La Quiaca to Tarija, and from the point where the Arica line reaches the frontier by a direct route to Oruro.

AUSTRALASIA AND PACIFIC ISLANDS.

Design for the Australian Capital.—It is announced that the competition lately held for a suitable design for the laying out of Canberra, the site chosen for the capital of the Australian Commonwealth, has been decided by the award of the prize to a young architect in Chicago, whose design has been reproduced in the *Manchester Guardian*, and, from this, in the September number of *Civil Engineering*. The design embodies some novel but praiseworthy features, notably in the partial abandonment of the rectangular arrangement of the streets so generally adopted for new cities, but which experience has shown to be little suited to the requirements of easy transit. The winding course of the Molonglo river divides the city as planned into two nearly equal areas, and the outstanding feature is the grouping of the city round two main centres, one in each half, from which the principal streets will radiate; while other streets will likewise radiate from subordinate centres. The alluvial flats along the river's course will be utilized for parks, and for botanical, zoological and public gardens, while a series of lakes will be formed by damming back the stream.

The two main centres, octagonal in shape, are designed to contain respectively the Government headquarters and the Municipal headquarters and University, while it is proposed to place the Parliament House on an eminence close to the former centre, known as Camp hill, whence it will command the whole city. The topographical features of the site and its vicinity were shown on sketch-maps given in the *Journal*, vol. 35, pp. 319, 320.

POLAR REGIONS.

Cartographical Results of the Danish Expedition to East Greenland, 1906–8.—The *Geografisk Tidskrift* (1912, No. 5) presents a series of maps representing the results of the surveys carried out during the Mylius Erichsen Expedition of 1906–8, together with a commentary by Captain Koch, who, as already mentioned in the *Journal*, has this year returned to Greenland with the plan of crossing the inland ice from east to west. Two of the maps (1 : 1,000,000) give a general view of the region traversed. One of the results of the surveys is the demonstration that Greenland extends much further east than had been supposed. Instead of running in a nearly straight line from Lambert Land to Academy glacier, the coast takes a course which adds nearly 200 miles to its supposed length, at the same time increasing the area of Greenland by 150,000 square miles. A glance at these maps shows how fortunate it was that the expedition came to winter in Denmark harbour (76° 46′), in the very centre of the region which required the greatest amount of survey work. From Bessel fjord to Lambert Land (76°–79°) the many tortuous fjords and rocky islands made this very difficult, but to the north of Lambert Land the coast-line is less complicated: it was therefore possible by a great effort to form a complete map of it. The sledge expedition for this object lasted from the end of March until the beginning of December, 1907, and will bear comparison with the most difficult undertakings of the kind. Whilst elsewhere in the Arctic regions the ice melts in summer and for a short time gives place to open water or drift-ice, such is not the case in the great bays and fjords of North-Eastern Greenland. Even in Skærfjord it requires a number of favourable years to produce open water. Great stretches of the coast have a fringe of permanent ice, and only where the Polar current strikes the projecting points with full force is this barrier broken or removed. In the small sheltered fjords, however, the winter ice is generally broken up through the disintegrating effect of the rivers, and so in different years larger or smaller expanses of open water are formed in the recesses within the permanent barrier of ice. A remarkable state of things is thus brought about. Nearly the whole of Jökel bay, between 78° and 79°, is covered with inland ice, much of it floating. It discharges its surplus into the bay, and while a small portion then passes away northwards, the main body follows the wide passage to the south and fills up most of the bay. Only in the south-western corner do some glaciers, which here reach down to the sea, calve and form small bergs, which shows that there is sometimes open water here. Similar conditions exist in Nioghalvfjerd fjord north of Lambert Land, and in the Wandel sea between Nakkehoved and Denmark fjord. A map of "North-East Greenland" (1 : 500,000) includes the region round Denmark harbour, a region which was constantly investigated by the naturalists. The survey of the region round Dove bay was carried out on the basis of a rough triangulation. One of Denmark harbour and its immediate surroundings (1 : 100,000) gives an accurate idea of the entrance to Dove bay past Denmark harbour; and another (1 : 25,000) shows the neighbourhood of Storm

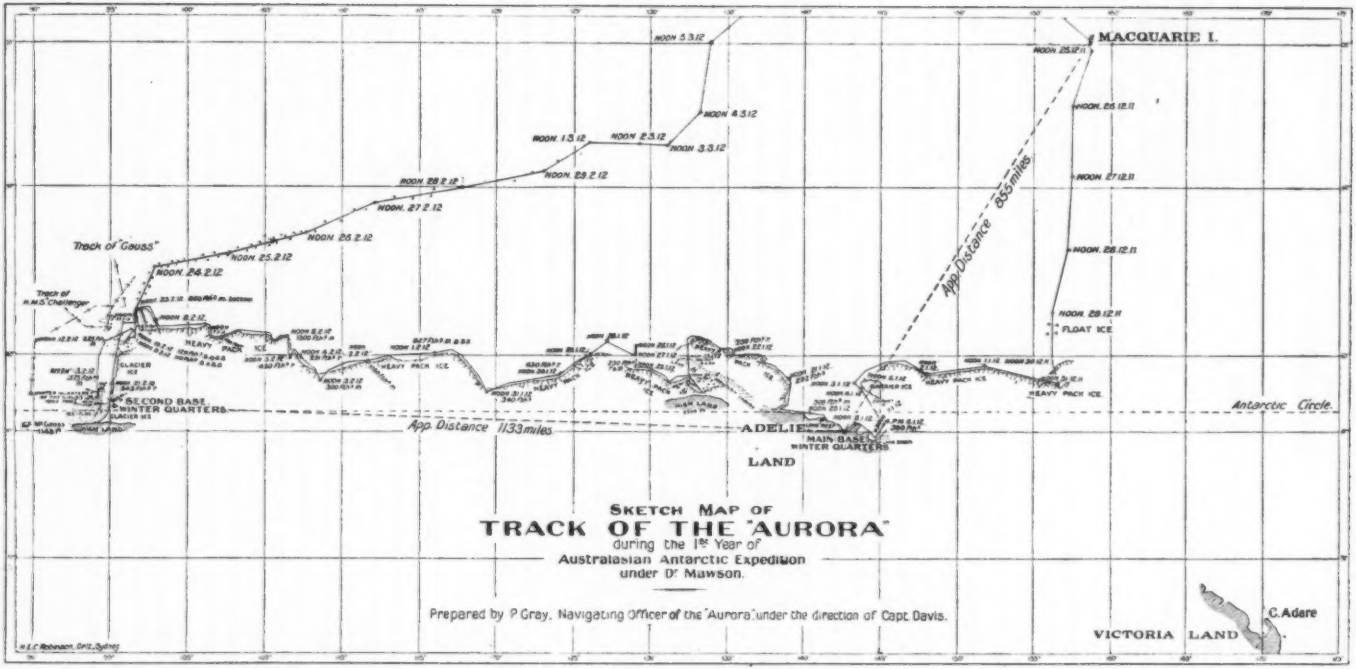
cape, 6 miles from Denmark harbour, where the naturalist, Herr Mannicke, erected an ornithological station. It shows the topographical conditions as they exist during the short period of thaw. Another special sheet shows the results of a detailed survey of the *Danmark's* winter quarters, on the scale of 1 : 2000. Lastly, a remarkable cave formation is illustrated by a sheet entitled "Gnipahulen" (1 : 4000). This formation, common in North-East Greenland, is caused by streams, during the period of thaw, forcing their way beneath perennial snow-drifts which fill up deeply-cut river-beds. At the Gnipahulen, the mass of material through which the passage has been made consists in its upper portion only of one-year-old snow: the remainder is solid ice. The cave may therefore be described as of a permanent character, even though the conditions alter somewhat from year to year.

Captain Scott's Expedition.—Commander Evans, R.N., second in command of Captain Scott's Antarctic Expedition, left this country for Sidney, *en route* for New Zealand, on August 30, accompanied by his wife and Mr. Francis Drake, Captain Scott's Secretary. He will probably sail from New Zealand in the *Terra Nova*, to take supplies to Captain Scott's party and bring the explorers back from the Antarctic, about the end of the year, but it is uncertain when the expedition may be expected to return.

Dr. Mawson's Expedition.—We reproduce on p. 448 the chart of the track of the *Aurora* when taking out Dr. Mawson and his companions to their winter-quarters in the Antarctic, which has been sent to us by Captain Davis. We have already (*Journal*, May, 1912) printed the joint report of Dr. Mawson and Captain Davis on the experiences during the outward and return voyage of the ship, and the landing of the wintering parties, and it is unnecessary to add anything here. An illustrated lecture on the voyage of the *Aurora* was given by Captain Davis in New Zealand towards the end of July in the presence of the governor, and a short report of it appears in the *New Zealand Times* of July 24. With regard to the wireless station installed on Macquarie island, Captain Davis mentioned that it was working splendidly, and had communicated with Suva, Fiji, 2300 miles away—a record for the southern hemisphere. Sounding and dredging operations were carried out by the *Aurora*, both during the return voyage and during a subsequent cruise on the Australasian coasts. The deepest sounding made was 2500 fathoms, south of Tasmania.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Greatest Ocean Depth.—According to a telegram despatched from Celebes in June by the commander of the German survey-ship *Planet*, which has been widely reproduced in the German scientific and other journals, a depth surpassing all previous records has been sounded by that vessel 40 nautical miles east of Northern Mindanao. The depth obtained was 9780 metres or 5348 fathoms, and the sounding was obtained under conditions which permit the fullest confidence in its accuracy, while a determination of bottom temperature and a sample of the sea-bottom at the spot were also secured. The greatest depth previously known was that found by the American ship *Nero* near Guam in 1899, which was fixed at 5268 fathoms. This has now been exceeded, therefore, by 80 fathoms. It will be remembered that previous soundings by the *Planet* had brought to light a series of hitherto unknown depressions of trench-form in this part of the Pacific, to the floor of which they give a somewhat remarkable character; and it would seem that the new depression belongs to the same series.



SKETCH MAP OF

TRACK OF THE "AURORA"

during the 1st Year of

Australasian Antarctic Expedition

under Dr Mawson.

Prepared by P. Gray, Navigating Officer of the "Aurora" under the direction of Capt. Davis.

GENERAL.

The Map-Collection at the Bibliothèque Nationale, Paris.—We have received from M. Léon Vallée, Chief of the Department of Maps at the Paris National Library, an annotated list of maps illustrating the history of cartography, lately exhibited by his department. Although somewhat restricted by considerations of space, the selection appears to have been judiciously made, the object being to call public attention to the cartographical treasures in the possession of the Department, and the advantages offered by it to students; no attempt was made to include official and other series of maps, the presence of which in the collection would be a foregone conclusion. Many of the items are of great interest for the history of map-making. Such are—the Portuguese Atlas, attributed by Denucé to the Reinels, dating from early in the sixteenth century; the planisphere of Sebastian Cabot, 1544; the various globes, also dating from the early part of the same century, known to students as "globe vert," "globe doré," etc., and many others. Among portolani we find specimens of the work of Soleri, Roselli, Benincasa, Agnese, Vesconte, Prunes, J. and F. Oliva, and others. A specially interesting item is the manuscript map of Normandy by the cartographer Jolivet (1545), while engraved maps of the sixteenth century include specimens of the Italian productions of Lafreri and his associates. Of later dates we notice, among many others, the celebrated Jesuit map of the interior of North America by Marquette. Maps and plans relating to France and its subdivisions are well represented, and include the original edition of the plan of Paris by Gomboust, 1652. Several items refer to Great Britain, the earliest being the rare sheet printed at Paris by Hierosme Gourmont in 1548. A certain number of books containing maps, or important for the history of cartography, are included. Among these are La Salle's 'La Salade,' 1527, so often quoted in connection with early indications of a southern continent. Besides originals, there are also reproductions of famous maps. The list itself seems to be without definite arrangement, but this is made up for by two excellent indices, one alphabetical, the other classified. The notes are brief, but helpful, and the catalogue will be a useful indication of some, at least, of the many important cartographical documents to be consulted at the Paris National Library.

OBITUARY.

Alfred Wallis Paul.

The death of Mr. Alfred Wallis Paul at the age of 65, which occurred on August 9 at his residence in Torquay, after an illness of only three days, came as a shock to his many friends. A Fellow of the R.G.S. for many years, his knowledge of all questions geographical and otherwise in matters connected with Sikkim and Eastern Tibet was unique. In his early service in Darjeeling he made the acquaintance of, and in most cases a close friendship with, the native notabilities, many of whom are now dead, and laid the foundations of the present friendly relationship with the then Tongsa Penlop, now Maharaja of Bhutan. He accompanied Sir John Edgar through Sikkim to the Jeylap and afterwards Coleman Macaulay and Sir Griffith Evans to Giagong, when the former was deputed by the Government of India to discuss various matters with the Sikkim and Tibet authorities, and he thus obtained an

intimate knowledge of the country and its communications invaluable to the later expeditions.

Mr. Paul was the son of Mr. Charles Paul, of Clifton, and was educated at Clifton College and was a scholar of Wadham, Oxford, where he rowed in the Trial Eights. He passed into the Indian Civil Service in 1868, and took his B.A. in 1870. The same year he went to India, and at first served in Dacca and Chittagong, later going to Darjeeling where almost the whole of the rest of his twenty-five years' service was spent, and where he made his reputation as an authority on Tibet and Tibetan affairs. Amongst other things, he compiled a very useful map of Tibet from information obtained from natives.

His many appointments included that of Deputy-Commissioner of Darjeeling, special duty with the Macaulay Mission of 1886, Political Officer with General Graham for the Sikkim Expedition in 1888, and finally British Commissioner for the settlement of the Anglo-Chinese Convention regarding Sikkim and Tibet. On the conclusion of the Convention he took leave for two years, retiring in 1896.

He received the C.I.E. for his frontier service in 1889, and the Frontier Medal for the Sikkim Expedition and also the Order of the Double Dragon of the 2nd degree from the Chinese Government.

He was a keen volunteer, and held the Long Service Volunteer Medal, and was a leading light in the Masonic Craft, in which he had taken many of the highest degrees, and was a Past-Master of the "Ancient Society of St. Stephen's Ringers," a very old Bristol guild. He also served on the committees of the Calcutta and Clifton Zoological Societies, and was a member of the Council of Clifton College 1896–1904.

The news of his death will be received with great regret by his numerous friends, and his name will long be remembered in Sikkim, Bhutan, and Tibet amongst the natives, in whose welfare he took so keen an interest.

J. C. W.

Dr. Ede, an old Arctic Officer.

The death of Dr. Charles Ede, followed so closely by that of Admiral Sir Vesey Hamilton, leaves only one survivor of the thirty-eight officers who sailed on the search for John Franklin and his gallant companions in 1850, namely, Sir Clements Markham.

Charles Ede was born in 1823, and entered the naval service in 1846 as an assistant-surgeon on board H.M.S. *Constance* on the Pacific station. There he was a shipmate of Mecham, second only to M'Clintock as an Arctic sledge-traveller, and with Dicky Pearse, another Arctic friend. Strangely enough, Ede had some experience of the treatment of scurvy on board the *Constance*. He was appointed to the Arctic Expedition of 1850 as assistant-surgeon of the *Assistance*, and at once took a leading part in all matters relating to health, comfort, amusements, and science, the latter as a collector and taxidermist. He it was who invented the method of converting the punt and its crew into a piece of ice to float down among the ducks at the Whale Fish islands. His gun largely supplied the ship with looms and dovekeys at Sanderson's Hope and in Melville bay. When winter came no one was more active in measures to keep off scurvy, and in the provision of amusements to maintain the spirits of the men. His were the Arctic songs, his the famous Arctic pantomime, his the snow statues of the Prince of Wales and Princess Royal on each side of the proscenium of the Royal Arctic Theatre, which were real works of art. He was most useful in the preparations for travelling, and was consulted by M'Clintock about the sledge crews. Ede himself commanded a sledge in the great

Cape Walker expedition (travelling 176 miles), and was afterwards with shooting parties on Cornwallis island. He was zealous, active, inventive, and energetic, always considerate for others, a good messmate, and a true friend.

On the return of Austin's expedition Dr. Ede was promoted, but retired from the service, married, and settled at Bramley near Guildford as a medical practitioner, where he led an active and useful life. After a residence at Bramley of 59 years, he passed away on August 25 last at the age of 89, deeply lamented by relations, by two old messmates, and a large circle of friends.

C. R. M.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1911–1912.

RESEARCH DEPARTMENT.

May 23, 1912.

Professor Myres read a paper on the work of the Research Department during the nine years of its existence.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic. *M. k.k. G. Ges. Wien* **55** (1912): 196–199. **Grund.**

Die vierte Terminfahrt S.M.S. *Najade* in der Hochsee der Adria vom 16. November bis 8. Dezember 1911. Von Prof. Dr. Alfred Grund.

See note, *ante*, p. 439.

Alps—Bibliography. **Coolidge.**
A list of the writings (not being reviews of books) dating from 1868 to 1912 and relating to the Alps or Switzerland of W. A. B. Coolidge. Privately printed. Grindelwald: J. Jakober-Peter, 1912. Size 9 × 6, pp. 38.

Alps—Geology. *Smithsonian Misc. Coll.* **56** (1912): No. 31, pp. 14. **Willis.**
Report on an investigation of the geological structure of the Alps. By Bailey Willis. *Sections.*

Austria—Alps—Historical. *M. k.k. G. Ges. Wien* **55** (1912): 200–227. **Sieger.**
Zum historischen Atlas der Österreichischen Alpenländer. Von Robert Sieger.

Belgium—Relief. *B.S. Belge Géol., Mém.* **25** (1911): 339–403. **Jerome and Greindl.**
Notes sur le modelé et le réseau hydrographique des terrains secondaires du Luxembourg. Par A. Jerome et le baron L. Greindl. *Map and Sections.*

Belgium—Rivers. *B.S. Belge Géol., Mém.* **25** (1911): 191–246. **Van de Wiele.**
L'évolution du Système fluvial de la Moyenne et de la Basse-Belgique. Par le Dr. C. Van de Wiele.

Denmark—Bornholm. *G. Arbeiten (Dr. W. Ule)* **Heft 6** (1910): pp. iv. and 98. **Reeps.**
Grundzüge einer Landeskunde von Bornholm. Von Dr. Karl August Reeps.

France—Anthropogeography. *B.S. Languedocienne G.* **35** (1912): 1–40. **Sorre.**
Étude sur la Transhumance dans la région Montpelliéraine. Par Max Sorre. *Sketch-maps.*
Noticed in the Monthly Record, August, p. 213.

France—Hydrology. *C.R.A. Sc. Paris* **154** (1912): 1550–1553. **Glangeaud.**
Changements hydrographiques produits par les volcans de la chaîne des Puys. Les lacs de barrage disparus. Par Ph. Glangeaud. *Sketch-map.*

France—Nord. *B.S.G. Lille* **57** (1912): 213–246. **Fichelle.**
Études de géographie humaine sur quelques communes de la haute vallée de la Deûle. Par Alfred Fichelle.

Holland—Amsterdam. **Muller & Co.**
Oud-Amsterdam. Geteekende, gegraveerde en gelithographeerde Stadsgezichten, . . . enz. Verzamelingen Wurfbain—Slagregen—Krocse, e.a. Amsterdam: F. Muller & Co., 1912. Size 12½ × 9½, pp. viii. and 164. *Facsimile Illustrations.*

Holland—Tides. **Beresteyn.**
Getijconstanten voor plaatten langs de kusten en benedenrivieren in Nederland, berekend uit de waterstanden van het jaar 1906. Door M. H. van Beresteyn. (From the Verhandelingen van het K. Akademie van Wetenschappen te Amsterdam, I. Sectie, Deel XI., No. 2.) Amsterdam, 1911. Size 10½ × 7½, pp. 70. *Map.*

Iceland—Earth-movements. *Z. Ges. E. Berlin* (1912): 246–248. **Spethmann.**
Ueber Bodenbewegungen auf Island. Von H. Spethmann.

Iceland—Population. *La G., B.S.G. Paris* **25** (1912): 292–297. **Stoll.**
L'Islande et sa population. Deux voyages d'exploration dans l'intérieur. Par Hermann Stoll.

Italy—Arno valley. *Rendiconti R.A. Lincei (Sc. Morali)* **20** (1911): 503–562. **Pieri.**
Dalla toponomastica della valle dell' Arno. Del prof. Silvio Pieri. *Sketch-map.*

Italy—Calabria. *Riv. G. Italiana* **18** (1911): 612–621. **Gignoux.**
Ancora due parole sulla geomorfologia della Calabria. Di M. Gignoux. *Sections.*

Italy—Elba. *Z. Ges. E. Berlin* (1912): 288–297. **Rühl.**
Elba. Von Dr. Alfred Rühl.

Italy—Lessini Mountains. *La G., B.S.G. Paris* **25** (1912): 173–178. **Fabiani.**
Formes singulières d'érosion dans les breccioles basaltiques des monts Lessini. Par Ramiro Fabiani. *Illustrations.*

Italy—Liguria—Coast. **Issel.**
B.S.G. Italiana IV. **12** (1911): 1085–1113, 1204–1234, 1315–1344, 1436–1454.
L'evoluzione delle rive marine in Liguria. Del prof. Arturo Issel. *Maps and Illustrations.*

Italy—Perugia. **Locci.**

Le provincie d'Italia sotto l'aspetto geografico e storico. No. 65. Regione Umbra. Provincia di Perugia. Compilazione di M. Pierfelici Locci. [Turin, 1912.] Size 7½ × 5, pp. 72. *Sketch-maps and Illustrations.*

The series is being continued after a considerable interval.

Italy—Tuscany. *B.S.G. Italiana*, V., 1 (1912): 227–254. **Barbarich.**

La Tuscia Romana. Del cap. Eugenio Barbarich. *Sketch-maps, Illustrations, and Section.*

Italy—Venetia—Tide. **R. Ufficio Idrografico.**

R. Magistrato alle Acque: Ufficio Idrografico; Pubblicazione N. 34. Sulla propagazione della marea nella laguna di Caleri. Venice, 1911. Size 10½ × 7, pp. 14. *Diagrams.*

Italy—Venetia—Water-levels. **R. Ufficio Idrografico.**

R. Magistrato alle Acque: Ufficio Idrografico; Pubblicazione N. 35. Dislivelli fra Adige e Brenta nella zona marittima (Studi nell' interesse della navigazione interna). Venice, 1911. Size 10½ × 7, pp. 10. *Map and Diagram.*

Mediterranean—Routes. *G.Z.* 18 (1912): 65–79. **Rohrbach.**

Die strategischen Passagen und Engen des Mittelmeers. Von Paul Rohrbach.

Norway—Glaciers. *Bergens Museums Aarbok* (1911): No. 7, pp. 54. **Rekstad.**

Kürze Uebersicht über die Gletschergebiete des südlichen Norwegens. Von J. Rekstad. *Sketch-maps and Illustrations.*

Rumania—Historical. **Ionescu-Dobrogeanu.**

B.S.G. Română 31 (1910): 42–112; 32 (1911): 77–122.

Scythia Minor, Berdjan, Dobrogia, Studiu istorico-geografic de Major Ionescu-Dobrogeanu.

Rumania—Place-names. *B.S.G. Româna* 31 (1910): 21–41. **Popescu-Ciocănel.**

Influența orientala in toponimia românească. De Cheorghe Popescu Ciocănel.

Russia—Grodno. *Zap. Imp. Russian Mineralog.* S. 47 (1909): 233–296. **Missuna.**

Materialen zur Geologie des Gouvernements Grodno. Von A. Missuna. I. Endmoräne und Gestält der Oberfläche im nordöstlichen Teile des Gouvernements Grodno. *Sections.* [In Russian; German *résumé.*]

Scandinavia—Fauna. *Ymer, Ts. Svenska S.G.* 32 (1912): 17–40. **Jägerskiöld.**

Om marina, glaciala relikter i nordiska insjöar. Af L. A. Jägerskiöld. *Maps and Illustrations.*

On the existence of a marine "relict" fauna in Northern lakes.

Spain—Aragon. *Spelunca* 8 (1911): No. 66, pp. 52. **Briet.**

Sous la Peña Montañesa (Haut Aragon, Espagne). Par Lucien Briet. *Sketch-maps and Illustrations.*

Sweden—Arc of Meridian. **Rosén.**

Meridiangradmatning vid Sveriges Västra Kust. Af P. G. Rosén. Upsala and Stockholm, [1911]. Size 11½ × 9, pp. 210. *Sketch-maps.*

Sweden—Geomorphology. **Tilmann.**

Sitzb. Naturhist. V. preuss. Rheinlande (1911): A; 29–44.

Ueber den Bau des skandinavischen Hochgebirges in Jämtland und Lappland. Von N. Tilmann. *Sketch-map and Illustrations.*

Sweden—Gotland. *Ymer* 31 (1911): 349–382. **Munthe.**

Hufvuddragen af Gotlands fysiskit-geografiska utveckling efter istiden. Af Henr. Munthe. *Map, Section, and Illustrations.*

Sweden—Phytogeography. *Arkiv. öfver Botanik* 10 (1911): No. 7; pp. 54. **Nordström.**

Iakttagelser öfver strand- och vattenvegetationen i vissa trakter af Medelpad. Af K. B. Nordström.

Sweden—Rainfall. **Institut Central de Météorologie.**

Appendice aux observations météorologiques suédoises, publiées par l'Académie Royale des Sciences de Suède, exécutees et rédigées sous la direction de l'Institut Central de Météorologie. Vol. 52, 1910. Les pluies en Suéde, 1860–1910. Upsala, 1911. Size 12 × 10, pp. 216. *Maps.* [In Swedish and French.]

Switzerland—Geodesy. **Schweiz. Geodätische Kommission.**

Internationale Erdmessung. Astronomisch-geodätische Arbeiten in der Schweiz. . . . herausgegeben von der Schweizerischen geodätischen Kommission, Organ der Schweizerischen Naturforschenden Gesellschaft. 13. Band: Polhöhen- und Schwerebestimmungen bis zum Jahre 1910. Zürich, 1911. Size 12½ × 9½, pp. vi. and 214. *Map, Plans, and Diagrams.*

Switzerland—Glacier. *Scottish G. Mag.* **28** (1912): 169–189. **Buchanan.**

In and around the Morteratsch Glacier: A study in the Natural History of Ice. By J. Y. Buchanan. *Portrait and Illustrations.*

Switzerland—Zurich. *Meteorologische Z.* **28** (1911): 545–555. **Maurer.**

Die Verdunstung auf den Seen am Nordfuss der Alpen während der grossen Hitze- und Dürrezeit 1911. Von J. Maurer. *Sketch-map and Diagrams.*

See Monthly Record for April, 1912, p. 402.

Turkey—Dardanelles. *Petermanns M.* **58** (1912): I., 179–181. **Janke.**

Die Dardanellen. Von General-Major A. Janke. *Map.*

Turkish Empire. **Huntington.**

Physical environment as a factor in the present condition of Turkey. By Dr. Ellsworth Huntington. (Reprinted from the *Journal of Race Development*, vol. 1, No. 4.) [Worcester, Mass.], 1911. Size 9½ × 6, pp. 460–481.

Noticed in vol. 39, p. 596.

United Kingdom—Cheshire. **Harrison.**

Early maps of Cheshire. By William Harrison. [Reprinted from the *Transactions of the Lancashire and Cheshire Antiquarian Society*, vol. 26.] Manchester, 1909. Size 8½ × 5½, pp. 26. *Maps. Presented by the Author.*

United Kingdom—Geology. **Reid and others.**

Memoirs of the Geological Survey. England and Wales. Explanation of Sheet 337. The geology of the country around Tavistock and Launceston. By Clement Reid, G. Barrow, R. L. Sherlock, D. A. MacAlister, and Henry Dewey. London: Darling & Son, 1911. Size 9½ × 6, pp. vi. and 146. *Illustrations and Sections.*

United Kingdom—Inland navigation. *Ann. G.* **21** (1912): 40–49. **Demangeon.**

La navigation intérieure en Grande-Bretagne. Par A. Demangeon.

United Kingdom—Ireland—Drumlins. *Geol. Mag.* V. **9** (1912): 153–159. **Wright.**

The Drumlin Topography of South Donegal. By W. B. Wright. *Sketch-maps and Illustrations.*

United Kingdom—Ireland—Forestry. *Geol. Mag.* V. **9** (1912): 115–120. **Wright.**

On the occurrence of submerged forests in certain inland lakes in Donegal. By W. B. Wright. *Sketch-maps.*

See note on these two papers in the June number, p. 610.

United Kingdom—Nottinghamshire. **Lamplugh and others.**

Memoirs of the Geological Survey. England and Wales. Explanation of sheet 113. The geology of the country around Ollerton. By G. W. Lamplugh, J. B. Hill, Dr. W. Gibson, Dr. R. L. Sherlock, and B. Smith. London, 1911. Size 9½ × 6, pp. vi. and 94. *Sketch-maps, Diagrams, Sections, and Illustrations.*

United Kingdom—Scotland—Forth. *Scottish G. Mag.* **28** (1912): 225–263. **Cadell.**

The story of the Forth. By H. M. Cadell of Grange. *Sketch-maps and Illustrations.*

See note in the Monthly Record, June, p. 609.

United Kingdom—Suffolk—Historical. **Leslie.**

The history of Landguard Fort, in Suffolk. By Major John Henry Leslie. London: Eyre & Spottiswoode, 1898. Size 10 × 7½, pp. xvi. and 142. *Plans and Illustrations. Price* 12*s.*

ASIA.

China. **Richthofen.**

China: Ergebnisse eigener Reisen und darauf gegründeter Studien von Ferdinand Freiherrn v. Richthofen. 3. Band: Das südliche China, . . . herausgegeben von Ernst Tiessen; 5. Band: enthaltend die abschliessende palæontologische Bearbeitung der Sammlungen F. v. Richthofens, die Untersuchung weiterer fossiler Reste aus den von ihm bereisten Provinzen sowie den Entwurf einer erdgeschichtlichen Uebersicht Chinas, von Dr. Fritz Frech. Berlin: D. Reimer,

1911–12. Size 11½ × 8½, pp. (vol. 3) xxxii. and 818; (vol. 5) xii. and 288. *Sketch-maps, Illustrations, and Sections. Price (each) M.32. Presented by the Publisher.*

These volumes, together with the second part of the atlas, form the completion of this monumental work, of which the first part appeared in 1877.

China—Cities. *Deutsche G. Blätter* **35** (1912): 1–19. **Tiessen.**

Die chinesische Stadt. Eine siedlungskundliche Studie. Von Ernst Tiessen.

China—Earthquakes. *B. Seismological S. America* **2** (1912): 40–91, 124–133. **Drake.**

Destructive earthquakes in China. By Noah Fields Drake. *Sketch-map and Diagrams.*

China—Historical. **Hirth and Rockhill.**

Chau Ju-kua: His work on the Chinese and Arab trade in the twelfth and thirteenth centuries, entitled Chu-fan-chi. Translated from the Chinese and annotated by Friedrich Hirth and W. W. Rockhill. St. Petersburg, 1912. Size 10½ × 8, pp. x. and 288. *Map.*

China—Shansi—Minerals. **Nyström.**

The coal and mineral resources of Shansi Province, China. Analytically examined by Erik T. Nyström. Stockholm: P. A. Norstedt & Sons, 1912. Size 9½ × 6½. *Map and Illustrations.*

Japan—Formosa. *J. Tōkyō G.S.* **23** (1911): 478–486. **Ishii.**

The explanatory text of Topographical and Geological Map of Formosa. Compiled by the Bureau of Industry of Formosa. By Y. Ishii. [In Japanese.]

Japan—Hokkaido. *J. Tōkyō G.S.* **23** (1911): 712–717. **Mori.**

On the seiches of Lake Tōya in Hokkaidō. By N. Mori. [In Japanese.]

Japan—Nagasaki. *B.S.G. Italiana V.* **1** (1912): 366–382. **Monico.**

La città di Nagasaki. Di Alfredo Monico. *Illustrations.*

Japan—Norikura. *J. Tōkyō G.S.* **23** (1911): *passim.* **Kozu.**

Norikura Volcano. By S. Kōzu. [In Japanese.]

Japan—Soil temperature. *J. Tōkyō G.S.* **23** (1911): 751–757. **Kawamura.**

On the underground temperatures in Japan. By S. Kawamura. [In Japanese.]

Malay Archipelago—Borneo. *Sarawak Museum J.* **1** (1912): 17–29. **Douglas.**

An expedition to the Bah Country of Central Borneo. By R. S. Douglas. *Map.*

See June number, p. 612.

Malay Archipelago—Borneo. **Driessche.**

Ts. K. Nederlandsch Aardr. Genoots. **29** (1912): 192–210, 320–341.

Nota's betreffende de Landschappen Sambas en Pontianak der Wester-afdeeling van Borneo. Door Th. J. H. van Driessche. *Sketch-map.*

North-East Asia—Historical. *J. Tōkyō G.S.* **23** (1911): 829–836. **Ogawa.**

Japanese Northern Explorations during the Tenmei and Bunka periods. By T. Ogawa. [In Japanese.]

Philippine Islands—Climate. *Philippine J. Sc.* **6** (1911): 427–466. **Chamberlain.**

Observations on the influence of the Philippine climate on white men of the Blond and of the Brunette type. By Weston P. Chamberlain. *Map.*

See Monthly Record, July, p. 85.

Philippine Islands—Luzon—Geology. **Adams and Pratt.**

Philippine J. Sc. **6** (1911): A; 449–482.

Geologic reconnaissance of south-eastern Luzon. By George I. Adams and Wallace E. Pratt. *Sketch-maps and Illustrations.*

See note *ante*, p. 442.

Philippine Islands—Volcano. *B. American G.S.* **43** (1911): 903–916. **Pratt.**

The eruption of Taal Volcano. [By Walter E. Pratt.] *Sketch-map and Illustr.*

Philippines—Forests. *B. American G.S.* **44** (1912): 81–89. **Goode.**

The forests of the Philippines. By Prof. J. Paul Goode. *Map and Illustrations.*

Russia—Caucasus. **Merkulof.**

Guide to the mountains of the Caucasus. By V. A. Merkulof. (Issued by the Crimea-Caucasian Mountaineering Club.) With special excursion map of the

Black Sea littoral and the Central Caucasus. St. Petersburg: M. D. Lomkovski, 1904. Size 8½ × 6½. Pp. 32. *Maps.* *Price* 1 *ruble.*

See review, July number, p. 73.

Russia—Caucasus—Ethnology. *Petermanns M.* **58** (1912): I., 17-19, 135-139. **Dirr.**

Anthropologische und ethnographische Uebersicht über die Völker des Kaukasus. Von Dr. Adolf Dirr. *Illustrations.*

Siam—Coast. **Frandsen.**

Contributions to the knowledge of the East Coast of the Gulf of Siam. By Captain H. E. Frandsen. [MS., 1911.] Size 11 × 9, pp. 11 and 17.

South-East Asia—Railways. **Hosseus.**

Hinterindische Eisenbahnfragen. Von Dr. Carl Curt Hosseus. (From *Weltverkehr*, December, 1911.) [Berlin, 1911.] Size 12 × 9½, pp. 405-412.

Turkey—Archæology. **Thompson.**

Til-Barsip and its Cuneiform inscriptions. By R. Campbell Thompson. (Reprinted from the *Proceedings of the Society of Biblical Archæology*, February, 1912.) [London, 1912.] Size 9 × 6, pp. 66-74. *Facsimiles and Illustrations.*

Turkey—Asia Minor. *Deuts. Rundschau G.* **34** (1911-12): 163-175. **Endriss.**

Ueber den Taurus. Von Dr. Wilhelm Endriss. *Illustrations.*

Turkey—Palestine—Mount Hermon. *Alpine J.* **26** (1912): 32-36. **Lloyd.**

An ascent of Mount Hermon. By G. W. Lloyd. *Illustration.*

Turkey—Syria. **Holzmann**

Deuts. Rundschau G. **33** (1910-11): 17-22, 145-153, 353-359.

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Economic—Bean. *Kew B.* (1912): 209–213. **Stapf.**
A new ground bean. (*Kerstingiella geocarpa*, Harms.) With a note on the discovery of *Voandzeia Subterranea* in the wild state. By O. Stapf. *Illustrations.*

Environment. *J.G.* **10** (1912): 295–297. **Martzoeff.**
Robinson Crusoe. A study in the New Geography. By C. L. Martzoeff.
A study of Crusoe's adaptation to his environment.

Historical—Cosmas. *B.S.G. Italiana*, IV., **12** (1911): 1455–1497. **Bertolini.**
Su la Cosmografia di Cosma Indicopleuste. Del Prof. G. Lod. Bertolini. *Facsimile Illustrations.*

History of Geography. *Deuts. Rundschau G.* **34** (1911–12): 109–114, 145–157. **Filek.**
Die geographischen Vorstellungen in Altertum. Von Prof. Dr. Egid v. Filek.

Man in the Tropics. *Popular Sc. Monthly* **80** (1912): 521–529. **Freer.**
Tropical sunlight. By Dr. Paul C. Freer.

Place-names—Rivers. *Deuts. Rundschau G.* **34** (1911–12); 157–162, 193–201. **Täuber.**
Gewässernamen (r + Vokal). Von Dr. C. Täuber.

Political Geography. *B.R.S.G. Madrid* **54** (1912): 7–67. **Giralt.**
Influencia de la enseñanza de la Geografía en la política exterior de las Naciones. Por Sr D. José Ricart Giralt.

GENERAL.

Encyclopedia. **Furtwängler and Weichert.**
Encyklopädie der Mathematischer Wissenschaften. Band vi., 1A: Geodäsie. Heft 1–3 (pp. 372). 1B: Geophysik. Heft 1, 2 (pp. 177). Band vi., 2: Astronomie. Heft 1–4 (pp. 556). Leipzig: B. G. Teubner, 1905–1912. Size 10 × 6½. *Diagrams.*
This work is still in course of publication. It consists of a series of monographs by specialists.

Geography. **Brown and others.**
The use of practical exercises in the teaching of geography. By Dr. R. N. Rudmose Brown and others. (Extract from the *School World*, vol. **14**, June, 1912.) London, 1912. Size 10½ × 7½, pp. 214–223.

Geography. *Popular Sc. Monthly* **80** (1912): 587–596. **McCourt.**
A philosophy of geography. By Prof. Walter Edward McCourt.

Orient—Communications. *M. k.k. G. Ges. Wien* **55** (1912): 127–145. **Banse.**
Die isochronenkarte des Orients. Von Ewald Banse. *Sketch-maps.*
The starting-point adopted is Cairo.

Portuguese Colonies. **Beazley.**
Prince Henry of Portugal and his political, commercial, and colonizing work. By C. Raymond Beazley. (Reprinted from The *American Historical Review*, vol. 17, No. 2, January, 1912.) N.P., 1912. Size 10½ × 7, pp. 252–267.

Portuguese Colonies. *Nineteenth Century* **71** (1912): 497–510. **Johnston.**
The Portuguese Colonies. By (Sir) H. H. Johnston.

Transliteration. **General Staff.**
A system for the transliteration of Persian, Afghan, and Arabian words. 2nd edit. The General Staff, India. Calcutta, 1912. Size 9½ × 6, pp. 84.

Year-book. **Wagner.**
Geographisches Jahrbuch, xxxiv. Band, 1911 . . . herausgegeben von Hermann Wagner. Gotha: Justus Perthes, 1911. Size 9 × 6, pp. x. and 468. *Price* 15*m.*
Reports of progress in Geographical Nomenclature, Ancient Geography, and Ethnology.

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EUROPE.

Austria. **Comai and Bischofberger.**

Schulhandkarte der Bezirkshauptmannschaft Liezen, herausgegeben von Ludwig Comai und Adolf Bischofberger. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. Vienna: E. Freytag & Berndt, [1912]. *Price* 32 *K. Presented by the Publishers.*

Austria. **Freytag.**

G. Freytag's Touristen-Wanderkarten. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: I. Wienerwald; II. Raxalpe, Schneeberg und Semmering; III. Der Otscher und sein Gebiet; V. Unteres Ennstal; XIII. Grazer Bergland. Vienna: G. Freytag & Berndt, [1912]. *Price* 2 *Kr. each sheet. Presented by the Publishers.*

Austria. **Kober.**

Schulhandkarte des Herzogtums Schlesien. Bearbeitet von Rudolf Kober. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Vienna: G. Freytag & Berndt, [1912]. *Price* 30 *K. Presented by the Publishers.*

Balkan Peninsula. **Peucker.**

Karte von Makedonien, Altserbien und Albanien. Bearbeitet von Dr. Karl Peucker. IV. Auflage. Scale 1 : 864,000 or 1 inch to 13·6 stat. miles. Vienna: Artaria & Co., 1912. *Price* 1.80 *Kr. Presented by the Publishers.*

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from August 1 to 31, 1912.

1-inch scale map:—

Third edition, engraved in outline. *Price* 1*s.*
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British Isles—Ireland. **Bacon.**

Bacon's Excelsior Railway Map of Ireland. By G. W. Bacon, F.R.G.S. Scale 1 : 480,000 or 1 inch to 7·5 stat. miles. London: G. W. Bacon & Co., Ltd., [1912]. *Presented by the Publishers.*

A diagrammatic general map of Ireland, without hill-shading, measuring 30 by 40 inches, printed in colours, with railways clearly indicated in red. By various symbols the different railway systems are distinguished from one another.

British Isles—London. **Bacon.**

Bacon's new map of the environs of London. Scale 1 : 63,360 or 1 inch to 1 stat. mile. *Price* 1*s.*—Bacon's large print map of London and Suburbs. Scale 1 : 31,680 or 2 inches to 1 stat. mile. *Price* 1*s.*—Bacon's large-scale plan of the City of London. Scale 1 : 5,280 or 12 inch to 1 stat mile. *With complete Index. Price* 1*s* London: G. W. Bacon & Co., Ltd., 1912. *Presented by the Publishers.*

These three maps should be useful for general reference. Special attention has

been given to railways, tram and bus routes, and the plan of the City of London is accompanied by an index to streets and important buildings.

Europe. **Freytag.**

G. Freytag's Automobil- und Radfahrer-Karten. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheet 10, Frankfurt a. d. Oder. Vienna: G. Freytag & Berndt, [1912].

France. **Michelin.**

Carte Michelin. France en 47 Feuilles. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. Sheets: 1, Calais-Lille; 5, Caen-Rouen; 13, Quimper; 25, Lons-le-Saunier. Paris: Ch. Delagrave, [1912]. *Price* 1 *fr. each sheet.*

Germany—Baden. **Grossherzogl. Badischen Geologischen Landesanstalt.**

Geologische Spezialkarte des Grossherzogtums Baden Blatt, 144. Stühlingen. Herausgegeben von der Grossherzoglich Badischen Geologischen Landesanstalt in Verbindung mit der Schweizerischen Geologischen Kommission. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Heidelberg: Carl Winter's Universitatsbuchhandlung, 1912. *Presented by the Swiss Geological Commission.*

Italy. **Istituto Geografica Militare, Florence.**

Nuova Carta topografica del Regno d'Italia. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 155, S. Severo; 156, S. Marco in Lamis; 157, Monte S. Angelo; 165, Trinitàpoli; 173, Benevento; 187, Melfi; 188, Gravina in Puglia; 198, Campagna; 199, Potenza; 209, Vallo della Lucania; 210, Lagonegro; 220, Verbicaro; 228, Cetraro. Florence: Istituto Geografica Militare, 1911. *Price* 1.50 *L. each sheet.*

These are thirteen sheets of a new map of Italy which was commenced two years ago by the Italian Ministry of War. It is based on the earlier surveys, which also serve as the foundation of the well known black and white map on the same scale, but in the present instance special attention has been paid to the representation of land relief, which has been drawn with great care after complete revision. The map is printed in five colours, the relief being clearly indicated by contours in brown at 50-metre intervals, combined with neutral tint shading, the result of which is decidedly effective and artistic. It is possible also to obtain the sheets without the shading, and with the relief shown in contours only. Roads and railways, the relative importance of which is indicated, are clearly shown, the former in red and the latter in black.

Switzerland. **Commission Géologique Suisse.**

Matériaux pour la Carte géologique de la Suisse, nouv. Série, Livr. XXVII. planche 1 (carte spéciale No. 64), Les Nappes de Recouvrement des Alpes Occidentales et les territoires environnants. Essai de carte structurale par Emile Argand. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. With 3 sheets of sections. Bern: A. Francke, 1912. *Presented by the Swiss Geological Commission.*

ASIA.

Asia Minor. **Philippson.**

Topographische Karte des Westlichen Kleinasien nach eigenen Aufnahmen auf Reisen, die mit Mitteln des Kais. Deutschen Archäologischen Instituts im Jahre 1900, der Hermann und Elise Geb. Heckmann Wentzel-Stiftung in den Jahren 1901, 1902, und 1904 ausgeführt sind. Entworfen von Dr. Alfred Philippson. Herausgegeben mit Unterstützung der Hermann und Elise Geb. Heckmann Wentzel-Stiftung. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Zweite Lieferung (Blätt. 2 und 4). Gotha: Justus Perthes, 1912. *Price* 8 *marks each sheet. Presented by the Publisher.*

These two sheets contain the country to the east of sheets Nos. 1 and 3, which were published in the first part two years ago. Sheet 2 extends in latitude from 39° to 40° 35′ N., and in longitude from 28° 10′ to 30° 25′ E., while sheet 4 continues the country immediately to the south as far as lat. 36° 25′ S. Relief is shown by contours at 100-metre intervals, each 500 being given in a stronger line, combined with shading in brown. Owing to imperfect knowledge of the topography of many districts these contour lines are necessarily very incomplete, and can only be considered as approximate, which might with advantage have been stated in a note on the sheets. Full information is given by symbols concerning the character of roads and tracks, the number of inhabitants in towns and villages, and religious buildings. Ancient sites are shown in red. For all students of the history and geography of this classical region, Dr. Philippson's map is invaluable. Two more sheets, Nos. 5 and 6, remain to be published to complete the map, and these will appear in the next part, and include

the country to the south of those which have already appeared. Separate sheets of the map can be obtained for 5 marks each.

India. **Survey of India.**

Maps published by the Survey of India during the quarter ending June 30, 1912. India and adjacent countries, scale 1 : 1,000,000, sheets 34 and 63 (provisional issue). Degree sheets, scale 1 inch to 4 miles: sheet 79 F (provisional issue); Bengal and Chandnagore, sheet 79 B (provisional issue). Standard maps, scale 1 inch to 1 mile: Bengal, sheets 83 D 3, 83 D 7; Bihar and Orissa, sheet 72 O 4 (preliminary edition); Berar and Hyderabad, sheets 46 P 15, 46 P 16; Bombay, sheet 46 G 9 and 13; Burma, sheets 92 L 12, 93 E 11, 93 E 13, 93 I 3 and 7, 93 I 4 and 8, 93 I 5, 93 I 9, 93 I 10, 93 I 11, 92 I 12, 93 J 1 and 5, 93 J 3 and 7, 93 J 4 and 8, 93 J 9, 93 J 11, 93 J 14, 93 J 15, 93 J 16; Central Provinces, sheet 64 N 4 and 8; Hyderabad, sheet 46 P 12; Madras, sheets 58 B 1, 58 B 6, 58 B 13, 58 B 15; Madras and Coorg, sheets 48 P 12, 48 P 16; Madras, Mysore and Coorg, sheet 43 P 10; Mysore and Coorg, sheets 48 P 13, 48 P 14, 57 D 4; Punjab, sheets 43 H 11, 43 L 2, 53 C 12 and 16, 53 H 4; Punjab, Kashmir and Jammu, sheets 34 L 11, 43 L 15; Punjab and United Provinces, sheet 53 H 6; United Provinces, sheets 53 L 1, 63 C 5 (preliminary edition); United Provinces and Central India, sheets 63 C 12, 63 C 16, 63 G 4, 63 G 8 (preliminary editions). Calcutta: Map Record and Issue Office, Survey of India, 1912. *Presented by the Surveyor-General of India.*

AFRICA.

Algeria. **Service Géographique de l'Armée, Paris.**

Sahara Algérien. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Sheet: Touat. Paris: Service Géographique de l'Armée, 1912. *Price* 1.40 *fr. each sheet.*

Egypt. **Egyptian Survey Department.**

Topographical map of Egypt. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets: First edition, S.W. XXII.–II. Mahariq, XXIII.–II. Kharga, XXIV.–II. Genâh, XXV.–II. Besheiw, XXVI.–II. 'Ain el Dôma, XXVII.–II. Barîs, XXVIII.–II. Dûsh; second edition, N.E. I.–I. Cairo West, I.–VI. El Agrûd, IV.–VI. Ballâh, V.–VI. Quantara, VI.–VI. Tina, VII.–V. Lake Manzala East, VII.–VI. Port Said. Cairo: Survey Department, 1912. *Presented by the Director-General, Egyptian Survey Department.*

Egypt. **Egyptian Survey Department.**

Topographical map of Egypt. Scale 1 : 10,000 or 6·3 inches to 1 stat. mile. Sheets: N.W. 18–7, 18–8, 18–9, 19–7, 19–8, 19–10, 19–11, 19–13, 20–12, 20–13, 20–14, 20–15, 21–17, 21–18, 23–9, 24–6, 24–10, 25–7, Mudiria Beheira; 30–5, 30–7, 30–8, 30–9, 26–6, Mudiria Gharbia and Mudiria Beheira; N.E. 11–12, 13–11, 13–12, 13–13, 13–15, 13–16, 14–12, 14–13, 14–14, 14–15, 14–16, 15–11, 15–12, 15–13, 15–15, 12–13, Mudiria Sharqîa; 26–7, 28–8, 28–9, 29–10, Mudiria Gharbia and Mudiria Daqahlîa. Cairo: Survey Department, 1911. *Presented by the Director-General, Egyptian Survey Department.*

Egypt. **Egyptian Survey Department.**

Map of the Delta. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. 4 sheets. Cairo: Survey Department, 1912. *Presented by the Director-General, Egyptian Survey Department.*

A good useful map in four sheets, each of which measures 23 by 30 inches. It is printed in colours, and shows governorate, mudiria and markaz boundaries, railways, existing and projected roads, desert tracks, canals, drains, and other information. Double, single-line, and light railways are shown by various symbols, while navigable canals and drains are distinguished from those that are unnavigable. Information is also given as to the width of canals, and a note states that canals under 15 metres and drains under 10 metres in width are omitted excepting where the larger canals are prolonged. The importance of cities and towns and their population is indicated, while other information is given on the maps concerning the position of wells, ferries, lighthouses, forts, antiquities, etc.

Kamerun. **Moisel.**

Karte von Kamerun, bearbeitet von M. Moisel. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheets: I.–1, Muni; I.–2, Ojem; I.–3, Mwine; I.–4, Ssembe. Berlin: Dietrich Reimer (Ernst Vohsen), 1912. *Price* 2 *M. each sheet. Presented by the Publishers.*

AMERICA.

Canada. **Surveyor-General, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 16, Milk river, Alberta, revised to June 6, 1912; 19, Willowbunch, Saskatchewan, revised to February 26, 1912; 64, Porcupine, Alberta and British Columbia, revised to January 29, 1912; 74, Cross lake, Manitoba and Ontario, revised to June 7, 1912; 111, Kamloops, British Columbia, revised to May 14, 1912; 116, Rainy hills, Alberta, revised to March 5, 1912; 167, Bad hills, Saskatchewan, revised to April 30, 1912; 169, Touchwood, Saskatchewan, revised to May 23, 1912; 217, Tramping lake, Saskatchewan, revised to April 30, 1912; 222, Waterhen, Manitoba, revised to May 10, 1912; 264, Brazeau, Alberta, revised to January 30, 1912; 316, Vermilion, Alberta, revised to January 18, 1912; 366, Saddle lake, Alberta, revised to February 15, 1912. Ottawa: Department of the Interior, Topographical Surveys Branch, 1912. *Presented by the Department of the Interior, Ottawa.*

Canada—British Columbia. **Provincial Bureau of Information, Victoria.**

Map of the northern interior of British Columbia, showing undeveloped areas. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Published by the Provincial Bureau of Information, Victoria, B.C., 1912.

Canada—British Columbia. **Department of Lands, Victoria, B.C.**

Map of the Province of British Columbia. Scale 1 : 2,217,600 or 1 inch to 35 stat. miles.—Map of the south-western part of British Columbia. Scale 1 : 760,320 or 1 inch to 12 stat. miles. Victoria: Department of Lands, 1912.

Canada—Manitoba. **Department of the Interior, Ottawa.**

Manitoba. Scale 1 : 792,000 or 1 inch to 12·5 stat. miles. Map showing disposition of lands prepared in the Railway Lands Branch. Corrected to January 1, 1912. Ottawa: Department of the Interior, Railway Lands Branch, 1912. *Presented by the Superintendent, Railway Lands Branch, Department of the Interior, Ottawa.*

Canada—Saskatchewan. **Department of the Interior, Ottawa.**

Saskatchewan. Scale 1 : 792,000 or 1 inch to 12·5 stat. miles. Map showing disposition of lands. Prepared in the Railway Lands Branch, F. C. C. Lynch, Superintendent. Corrected to January 1, 1912. Ottawa: Department of the Interior, 1912. *Presented by the Superintendent, Railway Lands Branch, Department of the Interior, Ottawa.*

Mexico. **Secretaria de Estado y del Despacho de Fomento.**

Carta de la Republica Mexicana. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets 5–II.–L, 6–I.–Q. Mexico: Secretaria de Estado y del Despacho de Fomento, 1911. *Presented by the Mexican Government.*

AUSTRALIA.

Western Australia. **Government Statistician, Perth.**

Map of Western Australia showing Statistical Areas. Distribution of Stock Statistics, 1910–11. Scale 1 : 3,168,000 or 1 inch to 50 stat. miles.—Map showing statistical areas in the south-west portion of Western Australia. Distribution of Agricultural statistics, 1910–11. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Map of Western Australia showing average rainfall at various stations to the end of year 1910. Scale 1 : 3,168,000 or 1 inch to 50 stat. miles. Perth: Department of Lands and Survey, 1911. *Presented by the Government Statistician, Perth, W.A.*

GENERAL.

World. **Debes.**

E. Debes' Neuer Handatlas über alle Teile der Erde in 65 Haupt- und über 130 Nebenkarten mit alphabetischem Namenverzeichnis. 4. Stark vermehrte und verbesserte Auflage. Lieferungen 19 u. 20. Leipzig: H. Wagner & E. Debes, 1912. *Price* 80 *Pf. each part.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, from July 14 to August 31, 1912. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 3775, The World: Curves of equal magnetic variation, 1912; Sheet I., Atlantic ocean, 3*s*. 96, Africa: Plans on Gold Coast: Axim bay, 3*s*. 306, Borneo: Simatahan and Serudong rivers (Plans: Silimpopon river), 3*s*. 624, Australia, south coast: Hobson bay, river Yarra and Melbourne, 3*s*. **New**

Editions—394, England, south coast: Spithead, 3*s*. 2290, England, south coast: Exmouth harbour. Plan added: Teignmouth, 3*s*. 2500, Scotland, west coast: Approaches to Loch Broom and to Little Loch Broom (Plan: Loch Kanaird), 3*s*. 1192, England, east coast: Hartlepool to St. Abbs head (Plans: Newbiggin bay, Eyemouth), 3*s*. 3104, England, east coast: Hartlepool to Blyth, 3*s*. 1934, England, east coast: river Tyne entrance, 3*s*. 3557, Plans in the Færoe islands: Vaag fiord. Plans added: Sorvaag fiord, Klaks road, Kvanne sund, Funding fiord, 2*s*. 2298, Gulf of Bothnia: Nyustad (Nystad) light to Stur (Stor) fiärd, 3*s*. 2295, Anchorages on the west coast of Norway (Plan: Trondhjem bay), 2*s*. 153, Mediterranean, France: Villefranche bay, Port of Nice, and St. Hospice bay, 2*s*. 1612, Mediterranean: Ports and anchorages in Dalmatia: Port Trau, Port, Makarska, Port S. Giorgio, Ports Verboska and Gelsa, Almissa road, Spalmadori channel, Citta Vecchia bay; New plan of Port Spalato on this sheet, 2*s*. 3567, North coast of Africa; Marsa Matruh, 2*s*. 3119, Mediterranean: Alexandria harbour, 3*s*. 2060*a*, North Atlantic ocean, eastern portion, 4*s*. 261, Plans in Arctic America: Winter harbour, Victoria harbour, Elizabeth harbour, Port Bowen, Port Neill, Port Leopold, Batty bay; Plan added: Northumberland sound, 2*s*. 2727, Gulf of St. Lawrence: Cape Breton island (Plan: St. Paul island), 3*s*. 478, West Indies, Puerto Rico: Port San Juan, 2*s*. 975, Gulf of Mexico: Approaches to Sabine pass; New plan of Calcasieu pass on this sheet, 3*s*. 373, Plans in the Gulf of Mexico: Coatzacoalcos river, Puerto Mexico, Alacran reef, Alacran port, Cay Arenas and adjacent reefs, Eastern and Southern Triangles, Arcas cays, Sisal reefs, Sisal reef, Madagascar reef, Anchorage off Sisal, 3*s*. 1396, South America, east coast: Parahiba river entrance, 2*s*. 1360, Africa, west coast, Barako to Cape St. Paul; Plan of Accra on this sheet erased, 2*s*. 1067, Africa, west coast: Loango and Black Point bays, 2*s*. 897, Africa, south-west coast: Milkbosch point to Orange river (Plan: MacDougall harbour), 2*s*. 648, Africa, east coast: Delagoa bay to river Zambezi (Plan: Sofala river); New plan of Port Bartholomew Diaz on this sheet, 4*s*. 671, Plans on the east coast of Africa; Merka anchorage, Obiat anchorage, Warsheik anchorage, Bander Alula anchorage, Illig anchorage. New plans of Brawa anchorage, Mogadiscio (Mogdishu) and Athelet anchorages on this sheet, 2*s*. 799, Kerguelen island: Royal sound (Plan: Island harbour), 2*s*. 2721, China sea: Cape Liant to Koh Kut (Plan: Chentabun river); New plan, Ban Yao river and Wain creek on this sheet, 3*s*. 1459, China, south-east coast: Hongkong harbour, 3*s*.

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Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly Meteorological charts of the North Atlantic and Mediterranean, August, 1912. London: Meteorological Office, 1912. *Price 6d. each. Presented by the Meteorological Office.*

Atlantic, South. **U.S. Hydrographic Office.**

Pilot chart of the South Atlantic Ocean, October and November, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Indian Ocean. **K. Nederlandsch Meteorologisch Instituut.**

Oceanographische en Meteorologische Waarnemingen in den Indischen Oceaan, Juni, Juli, Augustus, 1856–1908. Kaarten. Utrecht: Koninklijk Nederlandsch Meteorologisch Instituut, [1912]. *Presented by the Royal Netherlands Meteorological Institute.*

Indian Ocean. **Meteorological Office.**

Monthly Meteorological charts of the Indian Ocean, August, 1912. London: Meteorological Office, 1912. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, September, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, September, 1912; ditto, South Pacific Ocean, September, October, and November, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

N.B. It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

35°

9°

Routes in

SOUTH WESTERN ABYSSINIA

from

Plane-table and Prismatic Compass Traverses

by

GEORGE MONTANDON, M.D.

1910-11.

Scale. 1: 750,000 or 1 Inch = 11·84 Statute Miles

10 5 0 10 20

Reference.

Contours (approximate) at 500 feet intervals.
Heights in feet thus 5520
Routes .....
Telephone (working) .....
" *(disused)* .....

8°

7°

35°

…IA

For information concerning the construction of this map, see note at the end of Dr Montandon's paper which the map accompanies.

Tulu Mako
Darimu
Bedelle
Gattera
Adedjabo
Buno
Gaba
Dorenni
B U N N O
Borokka
Bilo
Bao
Urumu
Kodda
Bosaka Yera
Birro
diran
Kella of Bunno
L U B A B O R
Oge
Kersa-gogila
Cholbi
Bacho
Maji
Dachi
Sai
Magela
Fugo
Kodda
Kella of Guma
Melka Hidda
Gombotta
Gogga
Gale
Toho
Arga
Kumutte
Sapa
Batelle
Urache
Agalo
Tupa
Algo
Senka
Kotta
Enkia
Damma
Haro
Sombo
Boyo
Kuda
Allaga
Mato
Abonno
Chokorsa
Marti
Dogama
Bacha
Gawata
Butte
Gidda
Bolli
Shughi
Bitta
Gimbo
Gaddara
Baka
Gera Beki
Bitti
Bachi
Mago
Gori
Chulli
Buka
Kache
Mandi
Shechi
Gedageorgis
Bonga
Bonga Beki
Dulla
Shaki
Michi
Wacha
Wochi
Tama
Dishi
Boba
Gachab
Oriko
Bambaka
Shoa Gemira
Bennesho Mountains
Gurc-mancha

Published by the Royal Geographical Society

37°

Ameya

T. Bada Rogge
T. Sulá
10,420

B O T O R

Ochè
9260

Dabana

Didessa

Tobo

Darru Sadacha

Batella

Kiffan

Urgei

Gudo

Babia Gerarsa

Tokur

Tittobi

Busse

Dumoga

Boyra

Kitto

Ruda

Mato

Allaga

Bado

Sipano

Sarredo

Kalecha

Usakbi

Weno

Sucara

Korti

Bosha

Abenno

Unib

Shoki

Delldo

Lato

Carrima

Manshe

Dawar

Bamboo forest

Harbu

Moye

Gojeb

Dulla

Wocha

Buccate

Hella (Jella)

Chafarcha

Gura-mancha

Ganji

Abba (Manta)

Tocha

Diki

Geshe

Arata

Siba

Bare

Yadi

Buzo Chat

Nada

Kodi-wendabo

Gelle

Supe

Karsa

Awao

Tababuna

Birbirsa

Kaza-aire

Bazo

Omo

Gudo
11122

Garo

Dannaba

Onkure

Krupa

Saja

Kasha

Gazara

Mountains

Jimma

Gibbe

Didessa

Omo

Gibbe

Gojeb

Baro

Ghiba

Kuffa

Gurage

Kortawi

Alge

Kumbo

Bobbi

Kacha

Mansha

Shiro

Tulu Ali

Shanshama

Abalti

T. Dera

Badat

Kobjo

Manatti

Jejeba

Soyama

Ummuga

Iwer

Walga

Omocho

Bishu

Ogga

A g

G a

G

Omdurman

Khartoum

ANGLO-EGYPTI

KORDOFAN

Foga

Bara

el Obeid

Kawa

Sennar

el Nahud

Gedid

Kadero

SUDAN

Roseires

Rank

Abwat

Fasogli

Korun

Turda

Kodok

Taufikia

Sobat R.

Nuer

Dinka

Bahr el Ghazal

Nassar

Baro R.

Gelo or Baka R.

Akoba R.

Meshra er Rek

Bahr-el-Wau

Ghazal

Ghaba Shambi

Rumbek

Bahr el Jebel

Ber

Lado

Rejaf

Gondokoro

Yei

Nimule

Mangara

Kibou R.

Dufile

Wadelai

Aswa R.

Lake Albert

Fowera

UGANDA

Irumu

Mawambi

Semliki R.

Fort Portal

Ruwenzori

Kampala

Entebbe

VICTORIA NYANZA

Lake Edward

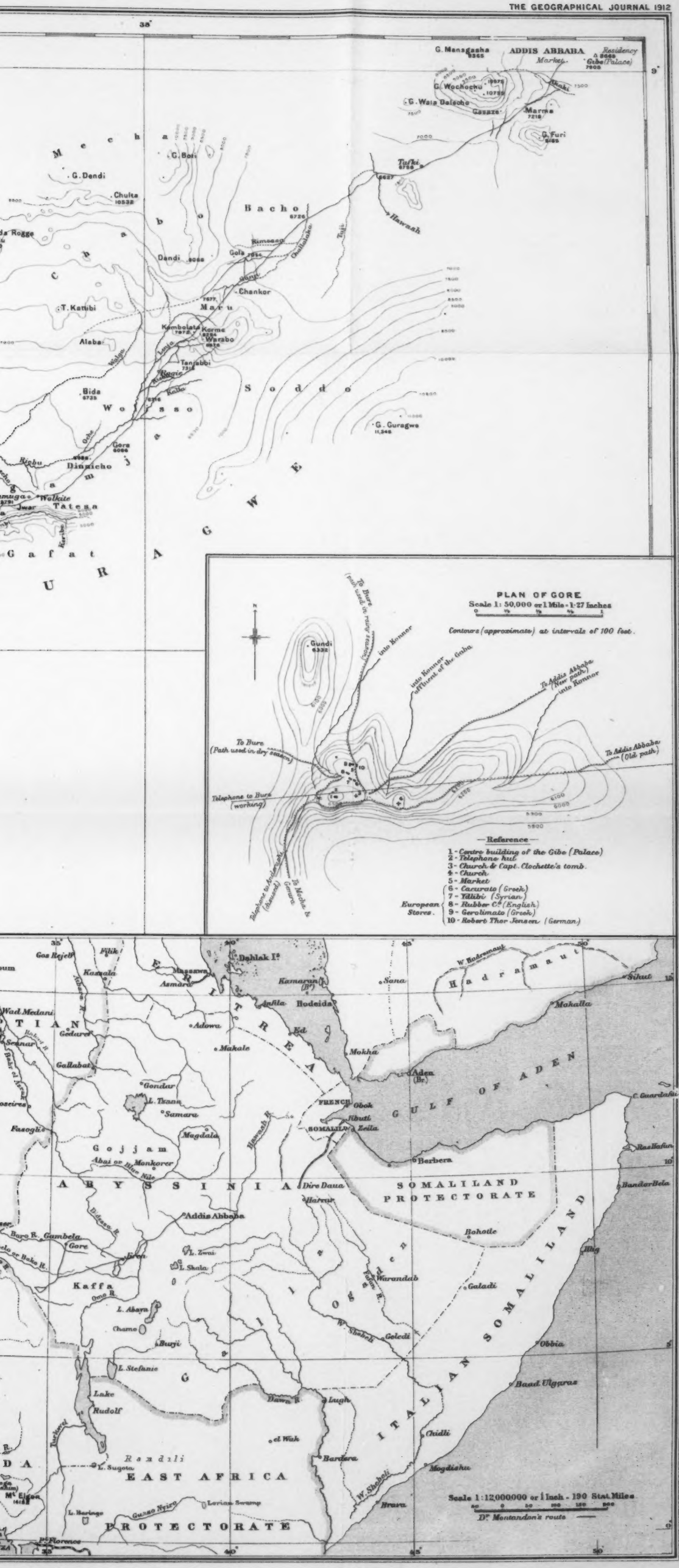
Mt. Elgon
14120

L. Kioga (Ibrahim)

30°

0°

37°



PLAN OF GORE
Scale 1: 50,000 or 1 Mile = 1·27 Inches
Contours (approximate) at intervals of 100 feet.
To Bure (Path used in rainy season)
into Konnor
into Konnor affluent of the Gaba
To Addis Abbaba (New path)
To Addis Abbaba (Old path)
To Bure (Path used in dry season)
Telephone to Bure (working)
Gundi
Reference
1 - Centre building of the Gibe (Palace)
2 - Telephone hut
3 - Church & Capt. Clochette's tomb.
4 - Church
5 - Market
European Stores.
6 - Carurato (Greek)
7 - Yalkiri (Syrian)
8 - Rubber Co. (English)
9 - Gerolimato (Greek)
10 - Robert Thor Jensen (German)

SOUTH WESTERN ABYSSINIA

MONTANDON